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NO. 5  
1960

MR. FRED ANDREGG, SUPERVISOR  
PHOTOGRAPHIC SERVICES  
UNIVERSITY OF MICHIGAN  
ANN ARBOR, MICH.  
A-8-61  
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January 1960



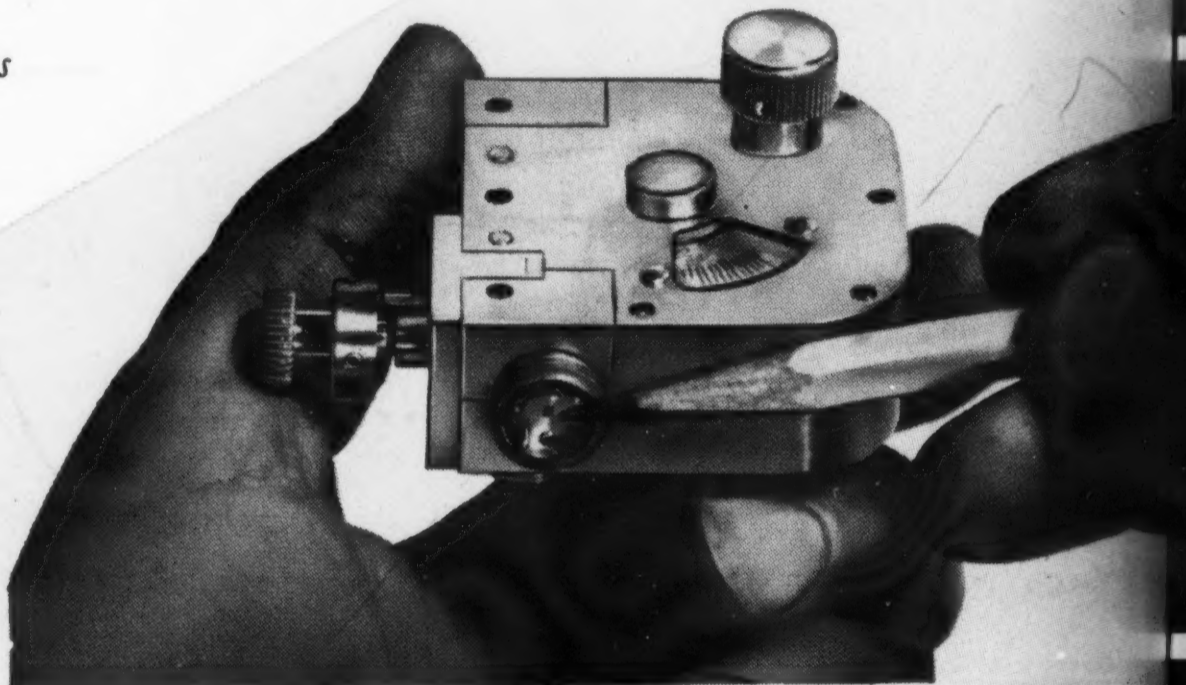
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## "...working in the 90-220 kmc frequency ranges?"

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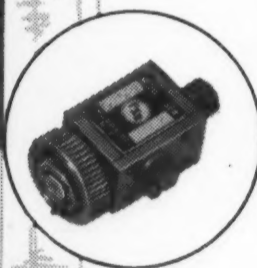
*Other components  
shown below.*

Slotted section, shown here, actual size.

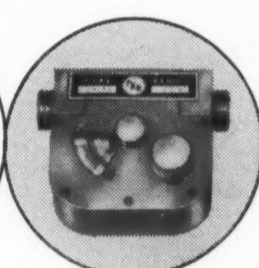


### FXR's Newly Developed and Proven 2-3 MM Components are Marvels of Precision and Reliability

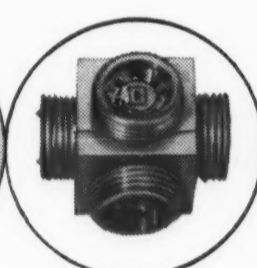
These miniature F-Band and G-Band components are not scaled down versions of their lower frequency counterparts. Rather, they are instruments of individuality and precision — products of advanced microwave engineering and new manufacturing techniques.



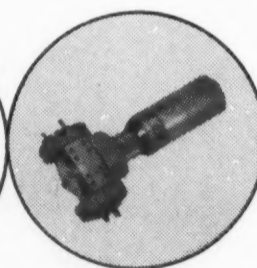
**DETECTOR  
MOUNT**



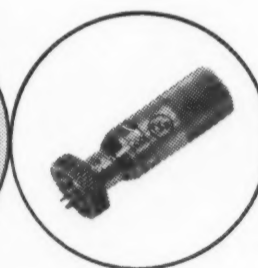
**PHASE  
SHIFTER**



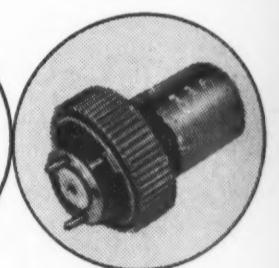
**E/H TEE**



**FREQUENCY  
METER**



**ADJUSTABLE  
SHORT**



**TERMINATION**



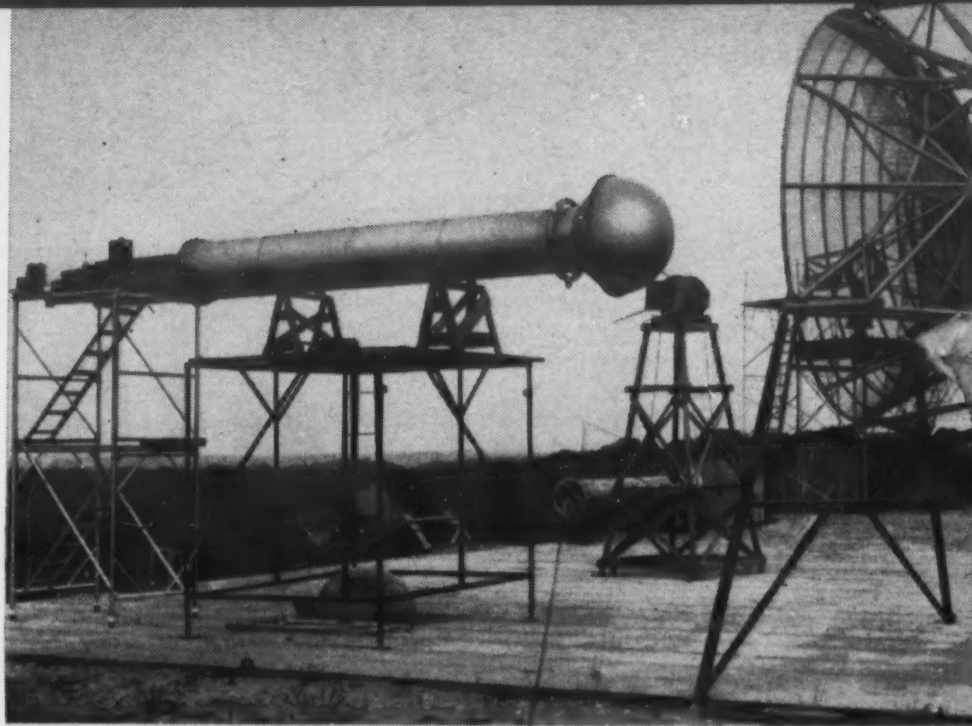
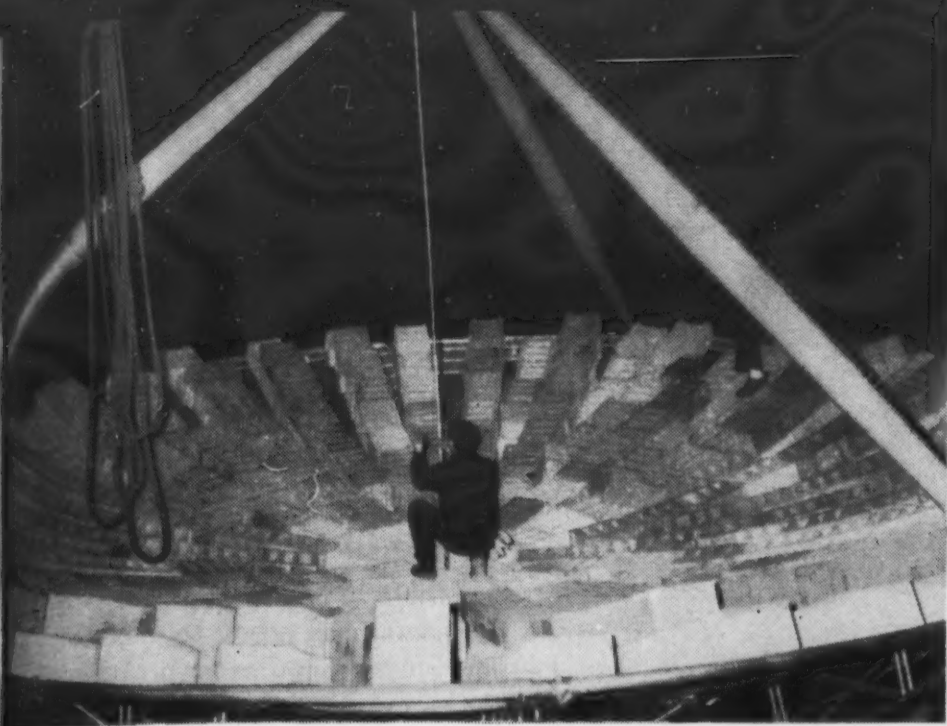
## FXR, Inc.

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Woodside 77, N. Y.

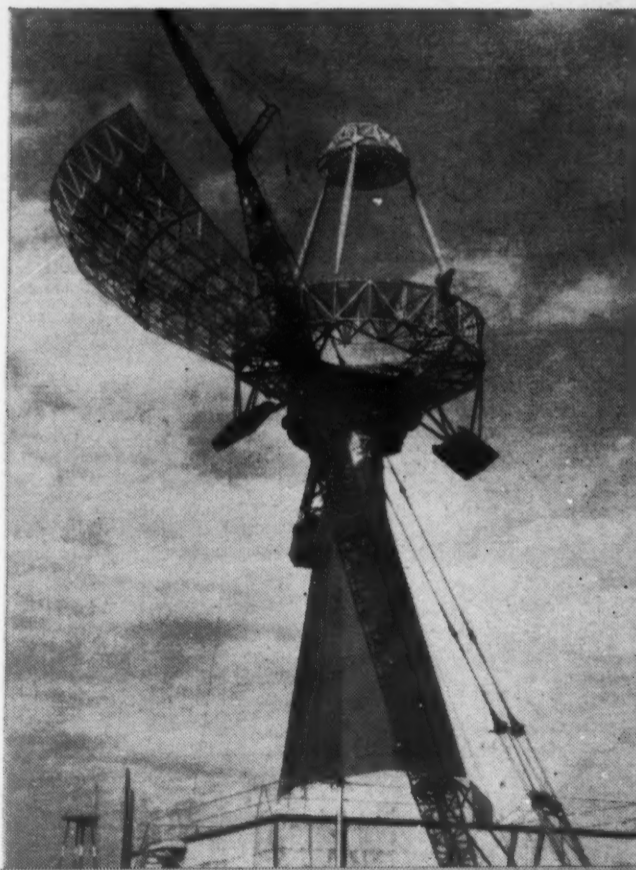
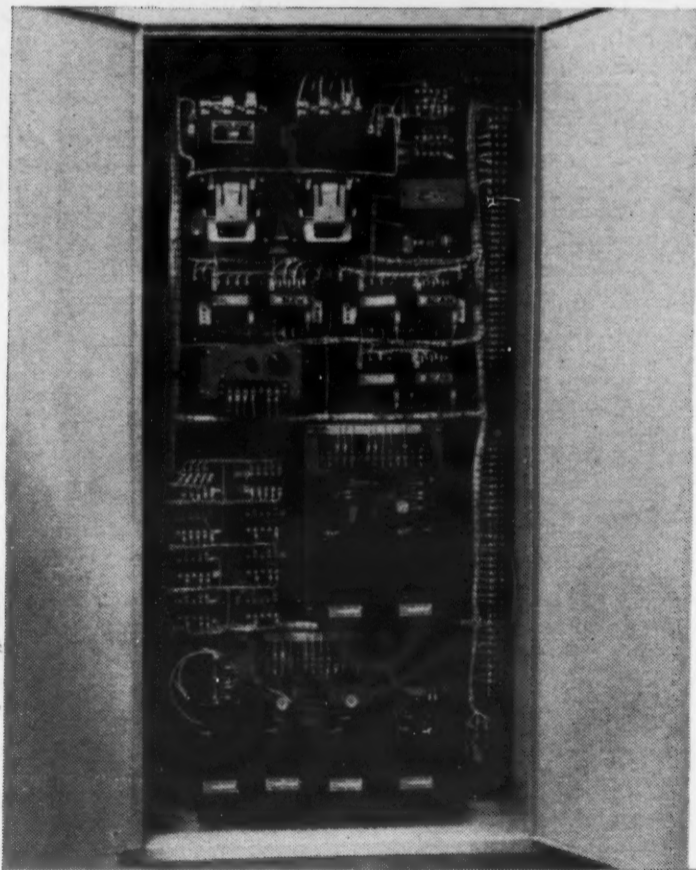
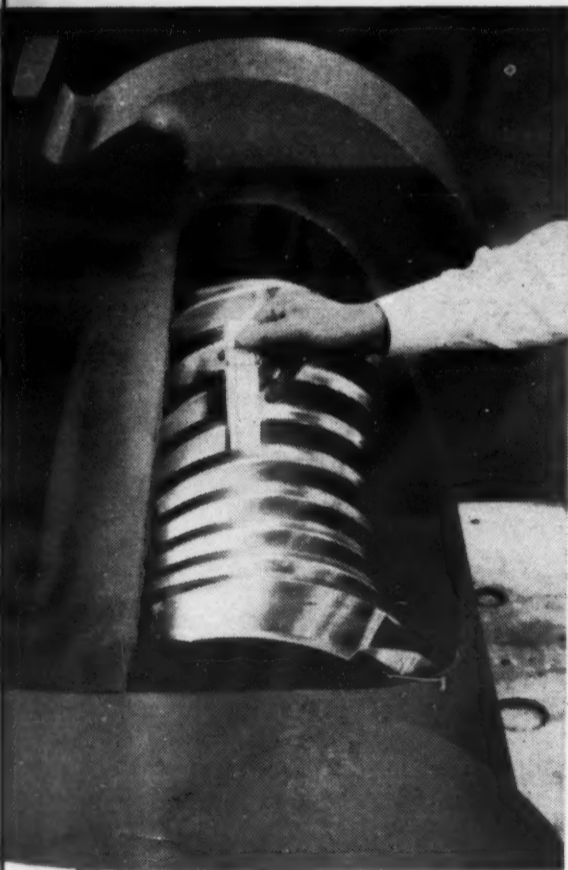
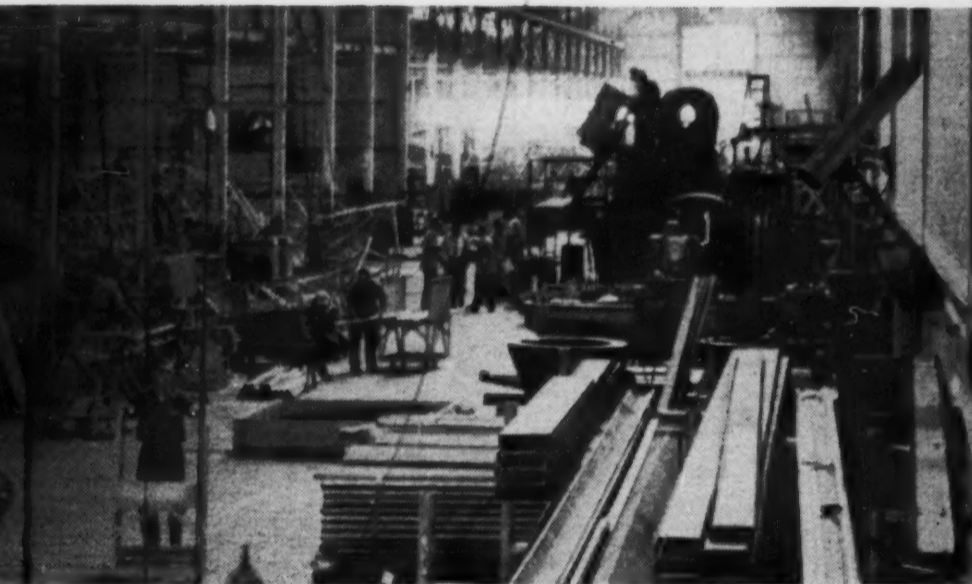
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*In antenna systems*

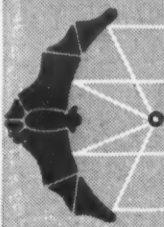
**KENNEDY** capability  
is total capability



**TOTAL** *capability in the field of antenna systems?*

It's the capability to do the basic R & D in microwave propagation . . . to design and develop the antenna system . . . to manufacture the dish, the mount, and all waveguide components, horns, etc. . . . to provide complete field engineering service which includes site surveying, construction and erection, final checkout, and servicing.

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## INFRARED... new and important uses from **Crosley**

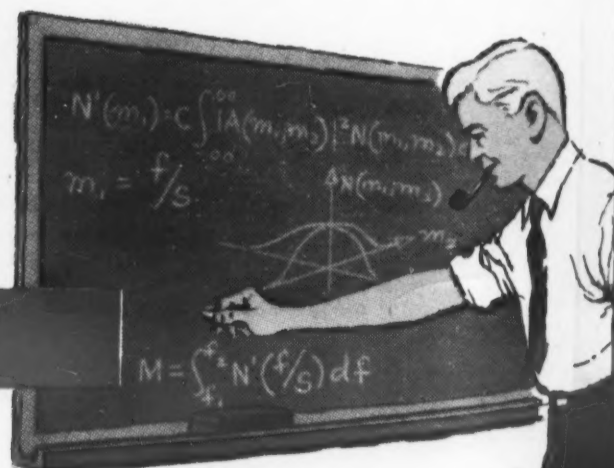
Infrared—which in World War II gave the expert marksman the power to see in the dark—now holds even greater promise. It may serve to provide early warning of approaching ICBM's if they are launched.

Infrared's singular use in World War II triggered a tremendous postwar effort to find other uses for its unique features. This effort, to which Avco's Crosley Division is a major contributor, has produced many applications in both industry and defense to which infrared is ideally suited.

Because they are so important to the national defense effort, most infrared research programs are classified as secret. But in general, Crosley's work in the field points toward new breakthroughs and conspicuous contributions in searching and tracking, anti-ICBM detection, airborne early warning and defense systems, reconnaissance, surveillance, anti-submarine warfare and passive ranging.

As a result of its progress in these areas, Crosley's team of infrared specialists—one of the largest in the country—is gaining the respect of a growing number of contractors.

*For more information, write to: Vice President, Marketing-Defense Products, Crosley Division, Avco Corporation, 1329 Arlington Street, Cincinnati 25, Ohio.*



### **ENGINEERS AND PHYSICISTS**

*Excellent career opportunities are available for all levels of Engineers and Physicists specializing in: Optical Design and Instrumentation, Infrared Systems, Physics of Infrared, Electronics with emphasis on Transistor Circuitry, Infrared Detectors and Components, Infrared Measurements and Mechanical Design. For further information, contact: Director, Technical and Scientific Personnel, Avco/Crosley, Dept. 8-10, 1329 Arlington Street, Cincinnati 25, Ohio.*



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**BPA**

# SIGNAL

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**NUMBER 5**

## CONTENTS

<b>The President's Page</b> .....	5
<i>Benjamin H. Oliver, Jr.</i>	
<b>The Influence of Nuclear Technology on Rockets and Space</b> .....	6
<i>John A. McCone</i>	
<b>Electronic Reliability—Key to Survival</b> .....	11
<i>Joseph Caldwell, Jr.</i>	
<b>A Special Announcement</b> .....	13
<b>CENTAG Communications—Flexible and Mobile</b> .....	14
<i>Colonel Emmett R. Reynolds, USA</i>	
<b>Air Force Uses of Space</b> .....	18
<i>Brigadier General H. A. Boushey, USAF</i>	
<b>Do We Have a Space Program?</b> .....	20
<i>Dr. William H. Pickering</i>	
<b>"Rayescent" Lamps—The Magic Light Source of the Future</b> .....	23
<i>C. F. Jensen</i>	
<b>Measuring Microwaves at Natural Level of Frequency and Power</b> ..	25
<i>Samuel Freedman</i>	
<b>Engineering in the Space Age</b> .....	31
<i>Major General Edward P. Curtis, USAF (Ret.)</i>	
<b>Spectrum Utilization in a Field Army</b> .....	36
<i>John J. Egli</i>	
<b>Functions of a Washington Office in Securing Government Business</b> .....	37
<i>Harry A. Carragher</i>	
<b>Forty Plus of Washington</b> .....	41
<i>Staff Report</i>	

## Season's Greetings

The Directors, Officers, the Executive Committee and National Headquarters of the Armed Forces Communications and Electronics Association wishes the sustaining, group and individual members a Happy New Year.

For the outstanding contributions of our authors and for the continuing support and services of our advertising representative and the advertisers in SIGNAL; for the complete cooperation of our printer, engraver, artist, members and friends, the editorial staff of SIGNAL is grateful and wishes to add its sincere holiday greetings.

## DEPARTMENTS

<b>Signalgram</b> .....	29
<b>Association Affairs</b> .....	44
<b>Reports From Regional Vice Presidents</b> .....	45
<b>New AFCEA Members</b> .....	46
<b>Sustaining and Group Member Directory</b> .....	48
<b>Chapters and Chapter Officers Directory</b> .....	50
<b>Chapter News</b> .....	52
<b>News Items and New Products</b> .....	58
<b>Photoprogess</b> .....	63
<b>Names in the News</b> .....	63
<b>Books</b> .....	65
<b>Index to Advertisers</b> .....	66

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for the B-58 Hustler's  
navigational and bombing  
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EXCELLENCE IN ELECTRONICS



BENJAMIN H. OLIVER, JR.

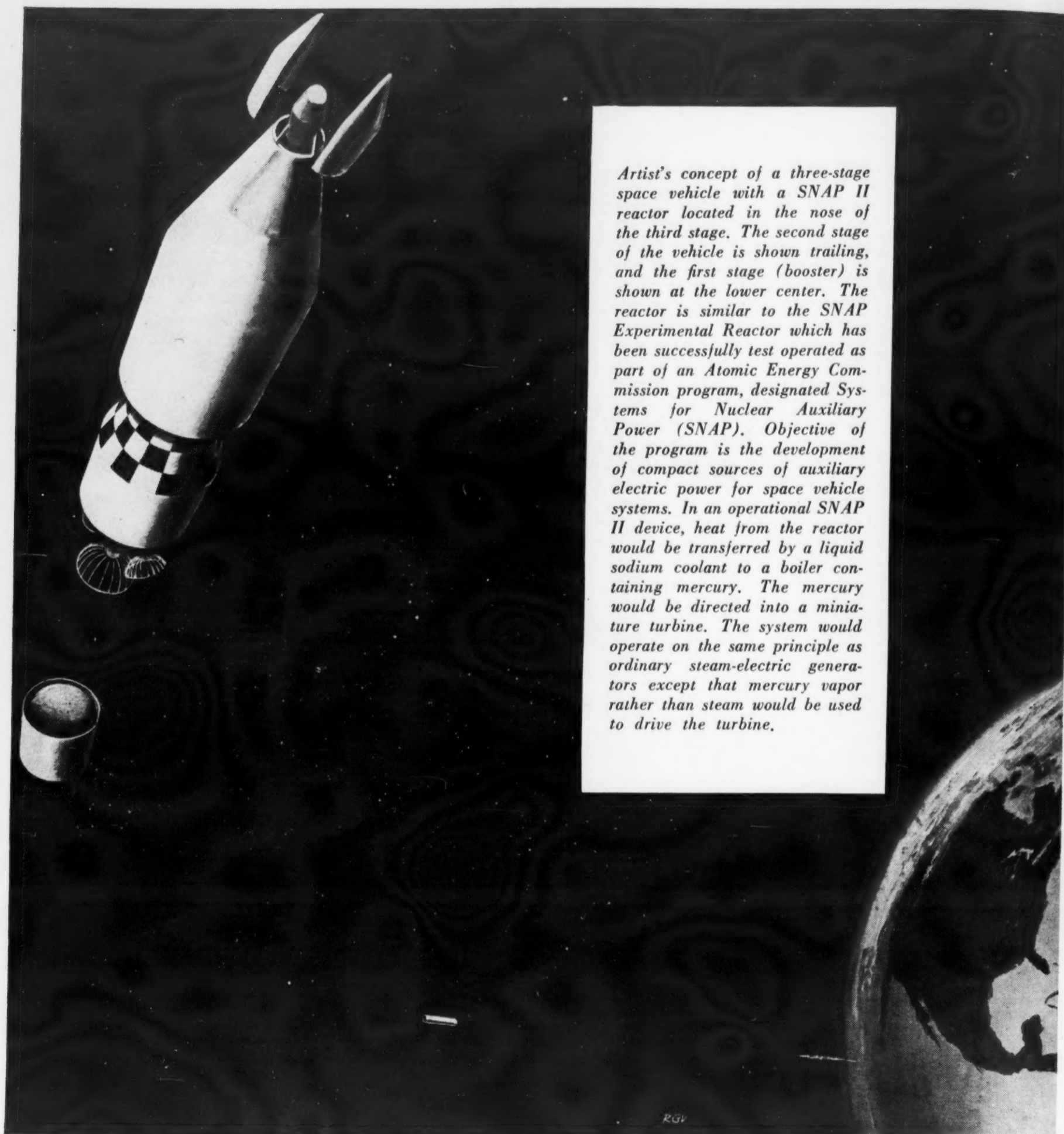
*Vice President, Upstate  
New York Telephone Co.*  
National President, AFCEA

The coming of a New Year is always significant to a person or an organization. It signalizes the passing of a milestone and the looking forward to a new goal. It's a time to reaffirm one's purpose for being. In the case of AFCEA, our purpose for being is to provide close liaison between military and civilian communicators and electronics people so that in the event of a national emergency no time will be lost getting into double harness.

Our organization is young but so is the industry it seeks to tie more closely to the service of our country. Our members are purposeful and understand the reason for the birth of our organization. Let's utilize our vigor to build each chapter to a peak of strong membership. Let's see that chapters prosper and are established in those places where they should be so that our mission can be better accomplished.

We at headquarters greatly appreciate the many fine accomplishments of the members in our 48 chapters. We count our blessings as great indeed to be associated with those listed on our AFCEA roster of sustaining, group and individual members. We extend to you the best of personal good wishes for the coming year and trust it brings with it a share of happiness for you.

*BH Oliver Jr*



*Artist's concept of a three-stage space vehicle with a SNAP II reactor located in the nose of the third stage. The second stage of the vehicle is shown trailing, and the first stage (booster) is shown at the lower center. The reactor is similar to the SNAP Experimental Reactor which has been successfully test operated as part of an Atomic Energy Commission program, designated Systems for Nuclear Auxiliary Power (SNAP). Objective of the program is the development of compact sources of auxiliary electric power for space vehicle systems. In an operational SNAP II device, heat from the reactor would be transferred by a liquid sodium coolant to a boiler containing mercury. The mercury would be directed into a miniature turbine. The system would operate on the same principle as ordinary steam-electric generators except that mercury vapor rather than steam would be used to drive the turbine.*

# THE INFLUENCE OF NUCLEAR TECHNOLOGY ON ROCKETS AND SPACE

BY JOHN A. McCONE, CHAIRMAN, ATOMIC ENERGY COMMISSION

MAN HAS BEEN looking toward the heavens through the ages. In my youth the moon in its heavenly firmament represented something remote and unapproachable.

Now our contemporaries are reaching toward the moon and beyond with confident expectation. This great adventure, in fact, our whole exploding technology, stems directly from man's irrepressible curiosity, his concern over his security, his meaning and his destiny.

It seems almost predestined that the development of nuclear energy and our readiness to explore space have coincided. We are ready now only because the necessary and essential advance work has been done in a logical sequence in communications and in metallurgy; in the physics and the chemistry of fuels both conventional and nuclear; and in a score of other scientific and technical matters.

In the field of missiles and space vehicles the atom is about to assume an indispensable role—a role which is certain to expand rapidly in the future. In my judgment the missile, because of the need for a dependable but still mobile base of operation, and the large space vehicle, because of its requirement for a powerful engine, and for a source of enduring power for transmission of data to earth, will find in the atom a solution for their now forbidding problems.

Let me give a few examples of the special contributions the atom will make to your business.

I am happy to be able to report that the *George Washington*, the Navy's first atomic powered submarine designed to fire the Polaris ballistic missile, has successfully completed her first sea trial. The ship met all requirements for speed, submersion and control.

It is significant and it should not go unnoticed that this latest and most

advanced nuclear powered submarine was brought up to full power within five hours after the sea trial was started. Each of the 10 nuclear submarines completed by the Navy has operated at full power on the first day of their sea trials.

Were it not for the development of the nuclear propelled submarine, accomplished through great dedication and determination—on the part of Admiral Rickover and other resourceful men—and in spite of almost insurmountable obstacles—the present concept of a Polaris weapons system would not have been brought into being. The effect of this great accomplishment has been to impart more mobility to our deterrent forces and enlarge the scope of our missile strategy.

Next year the Navy will place in operation a nuclear-powered cruiser. The year after a nuclear-powered aircraft carrier and a destroyer will join the fleet. All will have a capability of serving as missile platforms. Because of their unlimited range, these ships can cruise the oceans of the world, free of the fuel supply problems of conventional ships.

In the air, a nuclear-powered aircraft also seems to me a proper facility for an air-to-ground missile and for other military purposes as well. The nuclear aircraft with its difficult problems of high temperatures, adequate shielding and enormous weights has had tough sledding for the past ten years. So difficult has been the problem that many have despaired of its solution.

However, it now appears that there are not only one but two possible solutions to the development of a nuclear airplane whose flight characteristics will be reasonably satisfactory. It is my opinion that this development is important and that it must be brought into useful reality in the shortest possible time. However, in order to achieve this goal at the earliest practicable date, it seems to me to be desirable to concentrate on the most promising of the two concepts. This is one of the difficult decisions that needs to be made—and we should make it soon.

Still another area where the atom and the missile meet is the nuclear powered ramjet. This machine would use the air that it breathes to propel a missile or a reconnaissance vehicle at several times the speed of sound. The idea is not only feasible but is going forward rapidly in our Livermore Laboratory in California. Our scientists are so sure of success—despite technical problems yet unanswered—they are willing to forecast not only when the land based demonstration unit will be proven but also when the ramjet will be ready for operational use. This is PROJECT PLUTO.

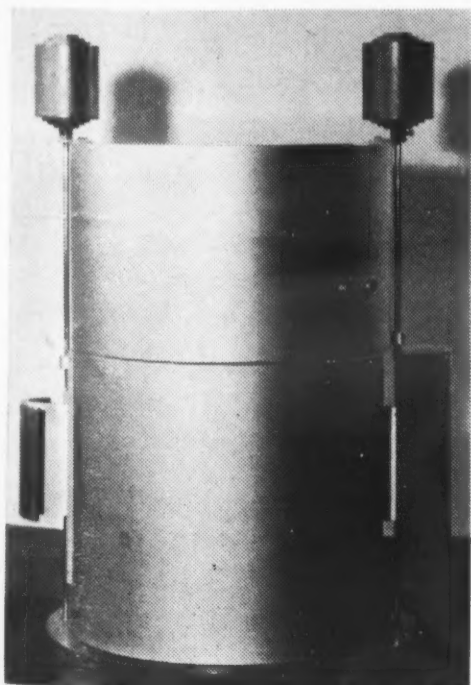
Turning now to the role of nuclear energy in space, the principal applications are two: first, as a source of energy to propel the rocket itself, and second, as a source of electrical power to meet the demands of satellites and space probes. This power, as you know, is desired for long periods of time.

Nuclear power offers to rockets the most energy per unit of mass of any fuel sources presently known. In fact, it is the only source of energy which promises the large quantities of power necessary to carry increasingly heavy payloads into outer space. This is our PROJECT ROVER.

Some months ago, the Los Alamos Laboratory, which is carrying on PROJECT ROVER, successfully tested the first experimental reactor designed for this purpose. This first model was not designed to fly and the scientists therefore in a humorous vein, nicknamed their initial experimental reactor "Kiwi" after the bird of Australia, which has never learned to fly. But this reactor and others to be tested in the immediate future are proving that a nuclear Kiwi can one day overcome the frustrating limitations of its feathered namesake—and later improved versions will fly—and in the not too distant future.

Regarding this point, it appears to me from both theory—and now from actual test—that the fantastic energy of the atom—the very high specific

(Continued on page 10)



Full scale model of a reactor similar to the SNAP Experimental Reactor which has been successfully test operated as part of an Atomic Energy Commission program designated Systems for Nuclear Auxiliary Power (SNAP). The model is 14 inches in diameter and 18 inches high. The protrusions at the sides are control drums which control the reactor's power and are operated by two control drive motors at the top.

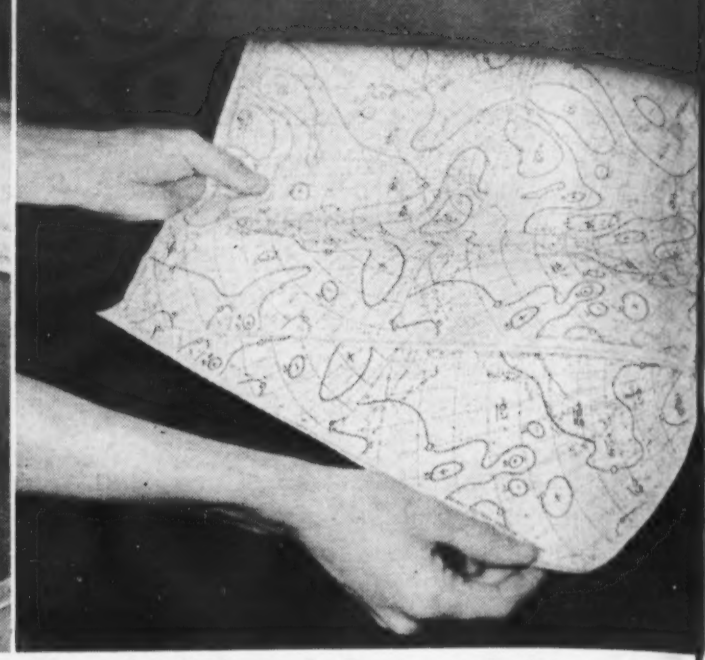
### Most commended features of ALFAX Maps



Crisp brown markings on clean white paper



Ease of writing and erasing enhances analysis



Clear crisp duplicates by Bruning or Ozalid

### • PLUS THESE UNIQUE FEATURES . . .

**LOW COST**—Alfax paper cost savings on full schedule operation save 1/3 to 2/3 in yearly operation costs.

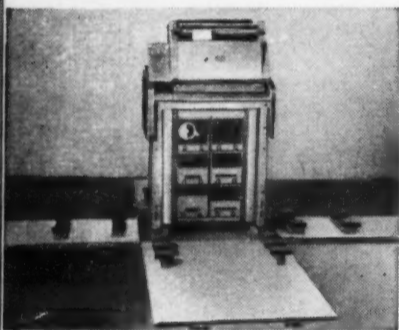
**CLEAN**—electricity is the ink for Alfax paper, ion deposits make crisp brown marks without dust, smudge or chemical irritants.

**STABLE** Alfax stores indefinitely . . . contains no voids or splices . . . recording marks are permanent.

## Here's why... FORECASTERS PREFER\* EQUIPMENT AND ALFAX

### Most commended features of ALDEN RECORDERS

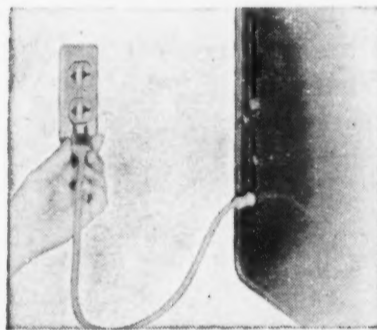
### • EASE OF INSTALLATION . . . compact and mobile



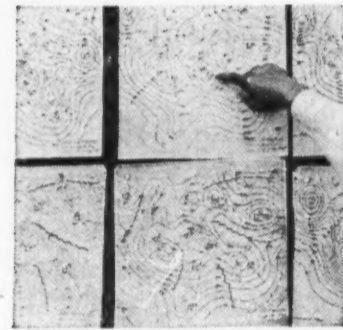
Uncrate



Roll in



Plug in

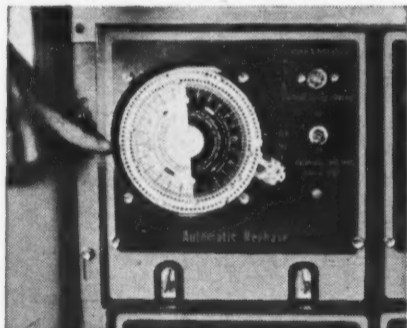


Clean crisp maps immediately

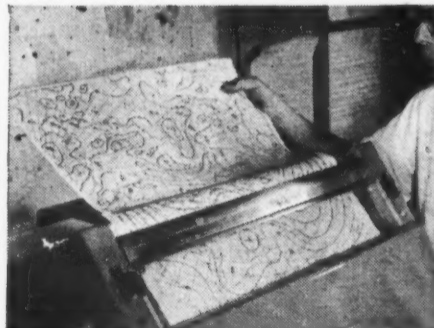
### • EASE OF OPERATION . . . new high in clean, quiet operation



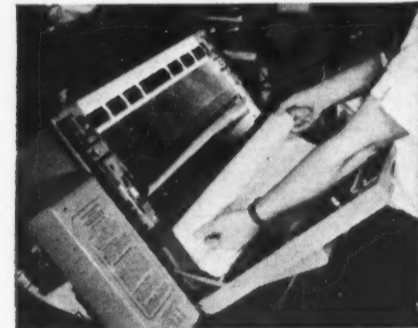
Automatic and continuous



Time clock programming

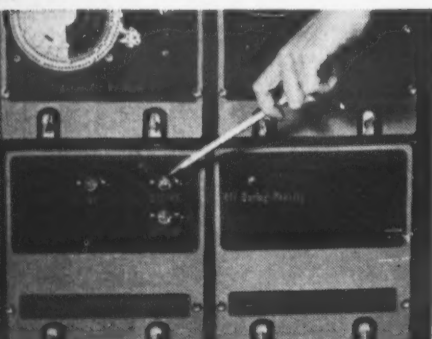


Instantly visible

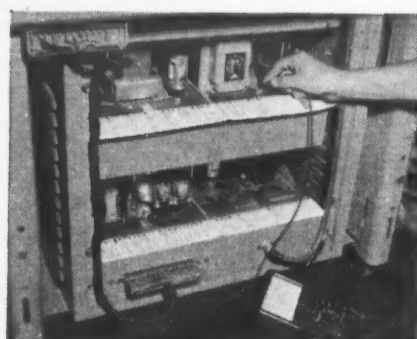


Easy paper loading

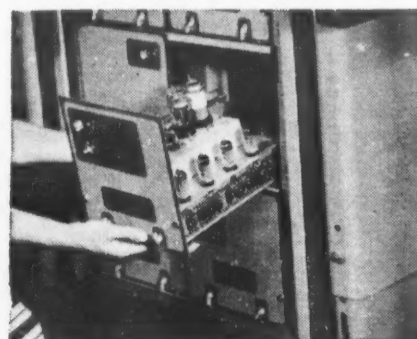
### • EASE OF MAINTENANCE . . .



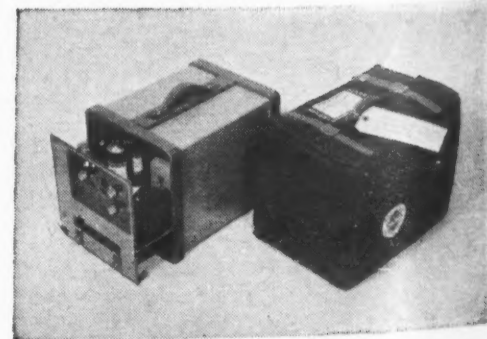
Front panel checks



Back connector checks



Plug-in construction



Air Freight replacement

### • PLUS THESE UNIQUE FEATURES . . .

**SECURITY**—low voltage marking process does not generate a signal that can be intercepted.

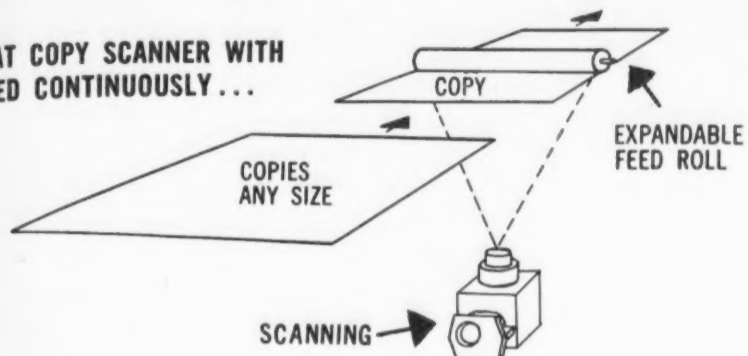
**HIGH SPEEDS**—60-90 or 120 rpm operation . . . recorder technique and paper capable of fifteen times these existing speeds.

**PRODUCTION**—designed for volume production on short lead time . . . using unique expandable manufacturing techniques.

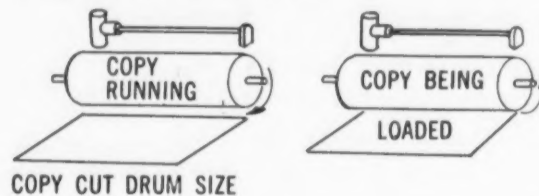
## NEW ERA IN CONTINUOUS FACSIMILE NETWORK OPERATION with ALDEN FLAT COPY SCANNING SYSTEM.

Compact, mobile flat copy scanners provided by Alden Electronic & Impulse Recording Equipment Co., Inc., Westboro, Mass. moved onto the new U.S. Weather Bureau Hi-altitude Weather Facsimile Network Feb. 16, 1959 to begin a new era in simplified facsimile communications systems.

ONE FLAT COPY SCANNER WITH COPY FED CONTINUOUSLY...



... REPLACES 2 DRUMS AND 2 SCANNER HEADS



...AND ELIMINATES COPY SIZE LIMITATIONS

### • INSTALLATION SIMPLIFIED . . .

Uncrated from fold-a-way shipping boxes at Suitland, Maryland, and Idlewild, N.Y. — Alden scanners rolled in, plugged in and turned on to begin new era in weather facsimile networks. Tested in 2 hours for 60, 90, 120 rpm, the equipment was turned over to the U.S. Weather Bureau personnel the same day. Addition of transmission and receiving points has been expanded with *higher speed operation* of 120 rpm started June 20th on completion of line balancing by American Telephone and Telegraph Co. which doubled the speed, transmitting copy of the same detail (size of characters and information *not* enlarged) as at 60 rpm.

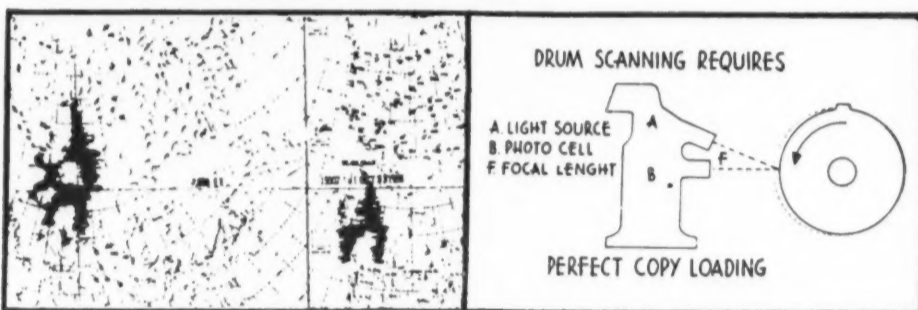
### • EASE OF COPY HANDLING . . .



With map sizes no longer restricted to drum mounting, continuous transmissions of maps (one after the other) with one scanner halves the space and maintenance problems, makes possible *scanning the original* plotted maps without cutting to size; map plotters and forecasters have *originals back in 1/2 the time*.

Flat Copy Scanner with expandable copy feed head takes maps any width or length — fed straight or kitty corner.

### • FOCUS SMUDGE ELIMINATED



Focus smudge caused by unusually thick copy or copy lifting from drum

With copy feed rolls precisely positioning surface of map on flat copy scanner table, exact focal lengths are maintained for clear, sharp recordings.

### • MOST COMMENDED FEATURES

Personnel familiar with prior facsimile scanning techniques, lauding this new breakthrough in weather facsimile techniques, highly commend these features:

- ease of copy handling
- compactness and mobility of equipment
- quietness and dependability of operation
- cleanness and sharpness of copy produced

## \* ALDEN FACSIMILE MAPS...

... and why we think you'll like them too.

Since 1954 Alden Facsimile Weather Map Recorders and Alfax maps have been replacing existing facsimile equipment on the National facsimile Weather Map Network at an accelerating rate.

U. S. Weather Bureau stations converting to Alden equipment will be complete by the end of the fiscal year with many independent forecasters, air lines and institutions following suit.

The new U. S. Weather Bureau's high altitude weather network, local and overseas networks are being expanded with Alden Facsimile Recorders and continuous flat copy scanners.

\* Fifteen out of twenty forecasters after having operating experience with all weather facsimile systems indicated a *marked preference* for Alden Recorders and Alfax Maps.

**ALDEN ELECTRONIC AND IMPULSE RECORDING EQUIPMENT CO., INC.**

Westboro, Mass.

Hi-Altitude Facsimile Weather Drops... are available from American Telephone and Telegraph Co. for qualified companies and organizations.

For others interested in facsimile communication systems, Alden Electronics makes flat copy scanner heads and recorders in all sizes and speeds (up to 30 times present network speeds), furnishing components to qualified manufacturers, and complete systems to end customers. *We invite your inquiry . . .*

## ***Influence of Nuclear Technology***

*(Continued from page 7)*

impulse obtainable—can be used successfully in a rocket engine. This we accomplish through the use of hydrogen as a propellant.

It is my judgment that this development will complement the chemical rocket engines and that the two in combination will provide the means for lifting large and heavy payloads into space. If placing large and heavy payloads in orbit is important—and here the judgment rests with science—then it is important that PROJECT ROVER be brought to operational readiness as quickly as possible.

Still another problem of space is the question of power generation. One of the present great handicaps of all space vehicles, ours and the Soviets' alike, is the limited time during which signals can be sent back to earth reporting conditions being encountered. This problem was first dealt with by resort to batteries and later with solar cells. Our most recent Explorer equipped with the new well known paddlewheels was a successful application of solar power.

Radioisotopes offer an alternate source of power. They, too, will produce from a few to several hundred watts of electricity. Certain of these devices are now in experimental use. All of you are familiar with them. One was shown to newsmen by President Eisenhower in January of last year. For certain missions they promise to be more useful than the solar battery because they can operate in environments where energy is not available from the sun.

In order to supply larger amounts of power we have developed a very compact lightweight reactor known as SNAP II, which will serve as a source of heat for the operation of a small turbo-electric generator. This has been a difficult problem because of the requirements of sustained endurance, light weight, high operating temperatures, and the requirement of operating outside the atmosphere.

I am gratified to be able to reveal that the Atomic Energy Commission has now successfully operated at full power and maximum temperature a compact reactor designed to provide several kilowatts of power for long periods in outer space. This first reactor weighs approximately 220 pounds and is no larger than a five gallon milk can.

The turbo-electric generator to be operated by the reactor is about the size of a football and will be capable of producing several electrical kw's.

So far I have been discussing those activities of the Atomic Energy Commission which bear directly on missiles, rockets, and space vehicles. In the time that remains, I would like to make certain observations on the general problems which confront us in maintaining our nation's technological pre-eminence.

Two years have gone by since the first Sputnik was placed in orbit. Though the initial shock and surprise have since been dulled, we, as a nation, still have reasons for serious concern. As a result of the Soviets' spectacular technical accomplishments during the period which bridged the great war and the Korean War, our technological superiority, which we took for granted no longer seems as secure. The Soviet space accomplishments have amazed the world and jolted all America into a new state of alertness. Our nation has thrived on competition. We now have a challenge of a most serious dimension.

It is clear that the substantial investments of both money and scientific effort which the Soviet Union has made in new technologies since the end of World War II are at the pay-off stage. We have not seen the end of their successes. I predict that we are in for still more surprises, especially in the field of rockets and space exploration.

History teaches us that there is an ebb and flow in the power and influence of mighty nations over the course of time. What is new here is the speed in which technology apparently can swing the tide and possibly affect the ingredients of national security and prestige. From experience, we know that technological advantage, once gained, tends to be self-sustaining. With this latter thought in mind I would like to report to you briefly some observations I made in the course of my recent trip to the Soviet Union.

It was my novel experience, in company with a number of our nation's atomic experts, to be permitted a close look at certain atomic installations in the USSR. Visits to many of these locations previously had been denied to Americans. To be sure, our look was limited to facilities concerned with the generation of nuclear power and other peaceful uses of the atom. What we saw, however, was enough to convince my colleagues and me that the quality of the Soviet work was first-class.

Moreover, their activities in the areas of our observations convinced me of their ability to concentrate on particular objectives agreed to be

important to the Soviet national interest and to treat such projects with a sense of great urgency. Their ability to marshal their scientific and technical effort and their material resources behind projects deemed by them to be important to their nation's interest is the reason for their spectacular success in certain special areas. They have not hesitated to make the hard choice between two or more almost equally promising alternatives in order to reach their end objective quickly.

Conducting such a program is not easy. Inevitably it means setting aside much that is felt by some to be desirable, but nevertheless will not, in the judgment of the deciding authorities, satisfy a paramount objective of early and successful accomplishments. The capacity for such decision is, in my opinion, why we have witnessed impressive Soviet gains in certain advanced areas of nuclear physics and atomic power developments. At the same time it was interesting to note that their over-all program was obviously being held in check.

This, I believe, also explains accomplishments in ballistic missiles and in space vehicles by a country which allows automobile production at a rate less than two percent of our own; a country that has reduced to a trickle production of manned aircraft; and a country that, by its own announcement, has canceled surface naval vessels, many of which were well advanced on the ways.

Does this mean that the United States has been dozing? Certainly not! We have made spectacular progress in many areas important to our security and to our well being. We must not forget or dismiss as unimportant all that we have done simply because in some areas the Soviets have done better.

I can recount numerous areas where our progress has been second to none—progress in medicine and in nutrition of benefit to the health of mankind and progress in the development of means to make secure our freedom and uphold the security of the free world. None, however, is more precious than the development of our intermediate and intercontinental ballistic missiles. This has been a great accomplishment.

Not only was the entire program carried forward in about four years' time but there has been produced a weapon system that is now exceeding expectations for accuracy and dependability.

Often I have asked why the Soviets

*(Continued on page 56)*

# ELECTRONIC RELIABILITY . . . .

## key to survival

by  
**JOSEPH CALDWELL, JR.**  
 Managing Director  
 Inland Testing  
 Laboratories Division  
 Cook Electric Company

**S**PACE AGE SURVIVAL demands instantaneous availability of information, instantaneous decisions and instantaneous defensive and offensive measures directed against an aggressor.

Electronics offers the only possible means of compressing these operations into the few minutes which are all that would stand between us and annihilation. Ironically, the very weapons and vehicles which threaten such devastating blows are themselves

ture about military electronics that anyone not directly engaged in the field may well ask what the hue and cry is all about. After all, we have been engaged in electronics on a substantial scale for a third of a century—why should reliability be a serious problem?

The answer can be put in rather simple terms. In an electronic system, any component part so situated that its failure or drift will cause malfunction of the system is, in effect, in series—it is a link in a chain. As we have called upon our electronic systems to perform more and more functions, with increasingly greater accuracy and stability, we have tremendously increased their complexity. We have made our chains very long indeed—some with nearly a million links. There will always be a weakest link. How can we make sure that the weak links will not let us down? This is the crux of the reliability problem.

All contributors to the Defense Program have become involved in the general effort to upgrade reliability of military equipment. The search for techniques to be used in the specification, attainment, and measurement of reliability has led to the use of a variety of approaches. Testing, in one form or another, constitutes a major element of all approaches. Consequently, we at the Inland Testing Laboratories have participated in nearly all the various methods. As specialists in this field we have had occasion to recommend, perform, monitor, or evaluate tests designed on the basis of many different philosophies.

Each of these test philosophies has its proper application, but none constitutes a panacea for all requirements. Often the purpose or significance of a specific approach is mis-



*(Above) Environmental Test Chambers at Inland Testing Laboratories, Morton Grove. Technician (foreground) is seated in front of electronic console which automatically measures component reliability data for recording on IBM punch cards. The intricate cabling permits voltage and resistance readings of thousands of individual components.*

a complex merger of electronic hardware. Electronics has opened space, and the future exploration of space will continue to depend upon our ability to use electronics for directing and controlling space vehicles and obtaining the data gathered by them.

The space age itself depends squarely upon electronics, and electronic reliability is the key to survival.

The word "reliability" now appears so frequently in all the litera-



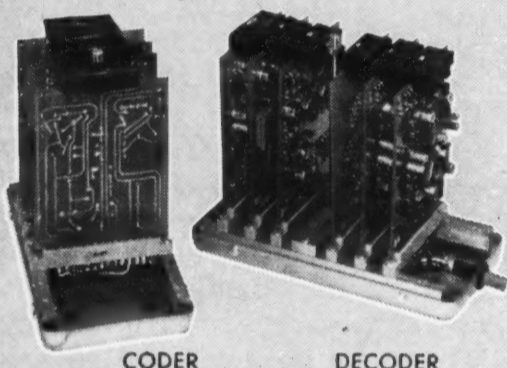
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understood. We have prepared a classification of the more common philosophies, pointing out the uses and limitations of each.

Fundamentally, the purposes to which the various types of tests may be put can be divided into two categories: the measurement of reliability and the increasing of reliability.

Reliability may be *measured* by laboratory (simulated-use), or actual field tests. If reliability is to be an enforceable contractual requirement, as it must be if our objectives of military effectiveness are to be achieved, means for its measurement must be specified. Although estimation or prediction certainly is possible and useful, measurement is mandatory for determination of compliance and for equitable comparison; for these purposes, no technique other than testing is available at this time.

Reliability may be *increased* by improvements in design, by improvement in manufacturing processes and controls. Testing of various kinds may contribute to each of these areas. For example, design improvements may be obtained by choice of component parts based on test results, and by circuit design which will accept, or even turn to advantage, parameter changes due to aging which are ascertained by testing. Manufacturing processes may be improved as a result of analysis of failures observed in final assembly tests.

During the last several years, Inland Testing Laboratories Division of Cook Electric Company has had extensive experience with still another technique for increasing the reliability of component parts. This is the use of screening tests to permit the culling of weak or defective parts prior to their installation in equipment. Environmental, electrical, and mechanical stresses are employed, singularly or in combination, to identify abnormal individual parts by their responses. The stress levels used must be nondestructive and non-degrading to normal parts and should bear some known relationship to application conditions.

A typical test procedure involves initial testing of the critical parameters of the component, followed by the stress exposure involved, and final measurements of the parameters. The change in parameter—in effect, the degree of instability—is customarily used as the accept-reject criterion. In some cases our screening tests—in the process of identifying “abnormal” parts—will reject not only components which differ from the normal by being worse, but also components which differ by being better. In a

sense, the tests impose a requirement of normality (mediocrity, if you prefer), for survival. This penalty is acceptable, however, for the reason that the outstandingly “good” component does less to improve reliability than the “poor” one does to degrade it; the removal from a population of equal numbers of unusually good and unusually bad components results, perhaps surprisingly, in overall reliability improvement.

Parts screening tests are designed to improve reliability, but not to measure reliability. The amount of improvement has been demonstrated in some cases, and can be estimated in others if the “raw” failure rate (without screening) is known. The derivation of a formula for screening effectiveness has been published.

Screening procedures inherently require 100 percent testing. They may be supplemented by destructive sampling tests for lot acceptance criteria on defects which are not discernible by nondestructive tests.

Obviously, 100 percent testing of the component parts used in production of a missile guidance system requires a highly specialized measurement capability because of the large quantities involved. Inland Testing Laboratories have provided an appropriate facility which includes 14 temperature chambers handling as many as 10,000 components each, automated punchcard readout systems for resistors, diodes, transistors and capacitors, plus a computer complex which makes summary data on parameter changes promptly available to the reliability engineering staff.

The concepts described have been developed and implemented at our Laboratories during the past three years in conjunction with reliability testing efforts which typically involve the processing of 60,000 component parts—resistors, capacitors, diodes, rectifiers, transistors, transformers—each month. Specifications involving the screening test concept have been written and rewritten on the basis of test results, and testing techniques and instrumentation have been modified to meet the new requirements. The accumulated experience is of great value to us and to those whom we serve.

As more data is gathered and put to use, reliability predictions are becoming more accurate and reliability control measures more effective. Thus, the planning and funding of programs to meet contractual reliability requirements can be placed on a sound basis for management purposes and for an effective defense capability. — — — — —

# **SPECIAL ANNOUNCEMENT: IN APRIL** *Now hear this! The*

*U. S. Navy is presenting the story of today's Naval Communications in the April issue of SIGNAL. AFCEA members will read about the Navy's increasing requirements and developments imposed by the Nuclear Era. The Navy straddles the spectrum of military communications from ocean floor to outer space. The Navy must be responsive to unique missions at sea, in the air and ashore. Even the colorful U. S. Marines will answer to roll call. Too little information has been published about the Navy's special requirements and the challenges facing U. S. Naval Communications. All this will be changed by April's All-Navy SIGNAL. Watch for it! (Editor's note: This is the second in a series of special issues. In March, 1959, SIGNAL presented the well-received Components Issue which was prepared by the U. S. Army Signal Corps. During 1961, SIGNAL, in collaboration with the U. S. Air Force, will publish another special issue.)*



## **IN MAY**

*As of this date, exhibitors have purchased 115 individual booths for the AFCEA Convention, May 24, 25, 26. While space is still available, we suggest you act now by contacting William C. Copp & Associates, National Exhibits Manager, 72 West 45th Street, New York 36, N. Y. Also, advance reservations for the Keynote Luncheon and Buffet Supper (May 24), Banquet (May 25) and Industrial Luncheon (May 26) are being accepted now at AFCEA National Headquarters, 1624 Eye Street, N.W., Washington 6, D. C. Details will be announced later in subsequent issues of SIGNAL.*



# CENTAG\*

communications—flexible and mobile



by COLONEL EMMETT R. REYNOLDS, USA

**"T**HE STRENGTH of an army, like the quantity of motion in mechanics, is estimated by the mass multiplied by the velocity." So said Napoleon.

The principle of fire and movement did not, of course, originate with Napoleon; undoubtedly it was applied from the time men first started warring against each other. In fact, it is so basic as to be an instinct. Acceptance is one thing, however, and successful application is another. For the two ingredients of this formula are inherently contradictory so that successful application requires the achievement of proper balance between the two. Military leaders who achieve that balance are in an enhanced position with respect to military success and, with the right opportunity, military greatness. And the course of military tactics swings like a pendulum between fire and movement.

With the advent of the nuclear age, augured by the explosion of the atomic bomb over Hiroshima, the pendulum moved far toward firepower and created a serious imbalance with resulting emphasis on the development of equilibrium—restoring mobility, or more properly, maneuverability.

Maneuverability, as used here, implies mobility and flexibility just as it did when it contributed so effectively to the brilliance of Napoleon's Italian Campaign. By staying light on his feet in the broad sense, he overcame the greater "mass" facing him. This same principle was epitomized by Jackson in his Valley Campaign; his movements represented a great deal more than simple mobility. Today, more than ever before, in the light of the overshadowing firepower of nuclear weapons, the student of military tactics must heed the admonition to retain flexibility and mobility—in less erudite terms, to "stay loose" or "keep your knees bent." More than ever before, success, indeed survival, on the battlefield depends on the ability of forces to move quickly, in any direction, to employ the tactics of dispersal, rapid concentration, quick exploitation. The necessary degree of maneuverability has increased proportionately with the emphasis and, in today's military parlance, is probably more accurately defined by the term "fluidity."

Effective fluidity means controlled fluidity; independent action must be integrated action. As the capability for fluidity grows so must the capability for controlling it.

The foresight which led to the pentomic division with its inherent organizational strength for meeting the challenge of the nuclear battlefield, particularly its adaptability to the requirement for independent action, also envisioned the availability of the means to control it and integrate it appropriately in time and space—the means for command control.

The word "means" immediately suggests equipment and men—communications equipment and the men to operate it. Furthermore, these tangible assets must possess at least the same degree of mobility and flexibility as the forces they support in order that they, in fact, may be an integral part of those forces. Simple mobility must be inherent in

equipment; flexibility must be achieved in part by equipment engineering and in part by the organization of the men and equipment.

One only has to pay cursory attention to the daily papers to be aware of the outstanding progress which electronic technology has achieved. A comparison of the state of the art today with that fifteen years ago produces a spectacular contrast. Furthermore, the rate of advance has bent sharply upward in the last half of that period. The standards of size, weight, reliability and flexibility are undergoing constant revision. As a basic consequence, so is the degree of mobility. Technology is meeting the challenge. So is the effort directed at adaptation to the pentomic concept of the organization which must convert equipment into the communications systems by means of which command control is exercised. A positive program for the re-design of signal organizations to improve their capabilities on the nuclear battlefield is being vigorously and perceptively prosecuted. Clearly, these two programs—technology and organization—are complementary and require deliberate phasing; each takes time and phasing takes more time.

Of vital importance to both research and development and organizational research is field experience. Consideration of practical and expedient solutions can, has and will place at the disposal of the researcher significant facts which may improve the ultimate product and/or reduce the time required to produce it. In addition, there is frequently a circumstance of immediacy in the field which must be accommodated.

Such was the situation encountered by the 17th Signal Battalion (Operation), the operations element of the 516th Signal Group which provides communications support for NATO's Central Army Group in Europe. CENTAG, of which the U.S. Seventh Army is the hard core, has wasted no time or motion in adapting itself to the changing concepts of military tactics. Exposed as it is to the possible immediate ground threat and its forward elements able to "see the whites of their eyes," CENTAG's success as a forward bulwark of NATO depends on its ability to fight a "conventional" battle or a nuclear one. Whether it will be called upon to fight, which type of battle and when are, to a degree, imponderables—a circumstance which further emphasizes the need for readiness. The maintenance of such versatile readiness creates a constantly changing, irresistible influence on tactical communications concepts and requirements. Adaptability to this influence was seriously handicapped by the organizational structure of the 17th and the limited type of mobility which it possessed.

The organization was characterized by centralization stemming from the "hardware" concept of organization. Discussion of the pros and cons of "hardware" versus "function" in the science of organization is not the objective here, so suffice it to point out that the centralized complexion of the battalion simply did not lend itself to the support con-

cept under which the battalion was required to operate. The Wire and Message Center companies in particular were simply pools of men and equipment from which the battalion headquarters extracted various sized detachments to accomplish specific tasks. The battalion mission was such that it could be divided into distinct sub-missions but there was no subordinate element of the battalion which could perform any one of these sub-missions.

Since no subordinate entity of the battalion could be considered the parent of a detachment, it was necessary to treat each detachment as a task force functioning under the direct control of the battalion staff. This mired the battalion staff down in detailed supervision, handicapping the performance of its planning and over-all supervisory functions, and obviously minimized the opportunity for delegation, the key to flexibility.

Mobility was similarly handicapped by the type and quantity of equipment on hand. Enough transportation was available to render the battalion approximately 60% mobile but this depended on the type of mobility required. The mobility actually consisted of the possession of enough transportation to move about 60% of the equipment authorized on the Table of Organization and Equipment, Equipment Modification Lists and Special Letters of Authorization. Movement of even this much, however, meant maximum loading as cargo and entailed extensive unloading and installation in tentage or buildings prior to operation. The only exceptions to this were the components of the Mobile Com-Center (AN/MS-5), mobile radioteletype equipments (AN/GRC-26) and power units. This type of mobility was completely inadequate to cope with the concept of command post mobility which was being supported. Communications simply could not move fast enough.

In response to these circumstances, the 17th Signal Battalion undertook two comprehensive programs—reorganization and communications mobility.

#### **Reorganization**

A reorganization study was initiated in October 1957 which culminated in the publication of a battalion general order in January 1958 effecting a complete realignment of resources and responsibilities within the battalion. The method of a battalion order was adopted for two reasons (1) time and flexibility and (2) the desired result could be achieved quickly and necessary refinements could be accomplished at the discretion of the battalion. Approval for this action, of course, had been secured from 516th Signal Group and United States Army Europe Signal Command. The rate at which these approvals were obtained was significantly increased by the interest taken by the Group Commander and the Commanding General of Signal Command (also the CENTAG Signal Officer) and the excellent cooperation of their staffs.

The next two months went by very quickly as the battalion, in a frenzy of activity, sought to accomplish its reorganization amid preparations for a full-scale CENTAG Command Post Exercise scheduled for March. Despite the advantages of reorganizing under battalion orders, there were some restrictive qualifications in the authority granted—reorganization had to be achieved within the grade and MOS structure of existing Tables of Organization and Equipment and within existing authorized strength. However, the challenge was met and on 1 March the first elements departed for the maneuver, physically reorganized, though personnel and property records had been outdistanced.

Benefits were immediately realized in the installation phase of the exercise and enthusiasm for the new structure grew daily. Quite contrary to their previous roles of fifth wheels, company commanders suddenly found major packages of responsibility in their hands, major sub-missions which they were expected to perform from start to finish, with their own resources. The battalion S-3 section was divorced from the details of circuit installation and operation, com-center manning and the myriad other tasks it previously had been burdened with. Now it devoted its energy to planning, coordination and supervision of the system. Platoon leaders remained with their platoons. Instead of becoming shift officers, reporting to the S-3 and

supervising men from another company, they supervised their own troops under the command of their own company commanders. Noncommissioned officers established, manned and supervised the activities performed by the same personnel that they lived and worked with in garrison. No longer was responsibility for major functions split; they were delegated intact.

Obviously this all didn't occur spontaneously; tradition isn't swept aside that easily. Nor would it be desirable to have a change of this magnitude and nature occur without some opposition. A degree of opposition was encountered at officer, NCO and technician level; opposition to the theory was slight, opposition to the techniques and finer points was more pronounced. Conviction came slowly to some and conviction was achieved in some instances only by refining the product. The result was a better product.

Obviously, too, the structure which had been designed on paper and organized under pressure had deficiencies. Careful scrutiny and analysis, observations by those looking at the forest instead of the trees and the satisfaction of those with reservations provided an acute evaluation. Correction of the deficiencies and general improvement were undertaken immediately and the refined organization was committed to another CENTAG CPX in June. Any doubts which had remained must surely have evaporated by the end of the June exercise. The results were outstanding and recognition came from all cognizant observers.

Final reorganization under authority of USAREUR came much more slowly. However, the time was filled with several additional field exercises, large and small, which further confirmed the validity of the reorganization and provided further refinement. On 5 February, 1959, the complete revision, including changes in the MOS and grade structure was effected by USAREUR general order. The only remaining restriction was the ceiling on its strength.

#### **New Organization**

As indicated previously, the underlying principle of the reorganization was delegation, the key to effective adaptation to the challenge of flexibility and mobility presented by the pentomic concept. The mission of the signal operations battalion can no longer be construed as static; its job is flexible, therefore its organization must be. Self-sufficiency at company level is an obvious requirement—self-sufficiency in terms of the means to accomplish an integrated portion of the battalion mission. This, in turn, permits commensurate application of the battalion staff to the planning, direction and coordination of the over-all, widespread effort. The new organization of the 17th Signal Battalion (Operation) comprised of the following elements: BN Hq, Hq and Hq Company, Companies A and B (Command Operations) and Company C (Field Operations) achieves this objective, as confirmed by extensive testing.

Each of the Command Operations Companies (Companies A and B) has the capability in men and equipment to support an echelon of the headquarters served and the capability for providing displacement or "jump" support in the event an additional echelon is established. Applying this capability to the current tactical concept, it is apparent that two major echelons can be supported and a move of either forward or backward can also be supported. Or, if the concept requires it, an alternate location for either can be supported. Most important, the complete mission for either echelon can be assigned to a single company.

Similarly, the long lines mission of the battalion is assigned to the Field Operations Company (Company C) which has the full long lines capability of the battalion.

Thus, the over-all battalion mission has been subdivided into three distinct, coordinated sub-missions, each representing a complete functional responsibility. These integral elements of the over-all mission are then assigned to an integral element of the organization, a company. Each company possesses the means, in men and equipment, to accomplish its assignment. The capability for delegating recognized responsibility has been obtained.

In addition to the elimination of divided responsibility for major functions, a number of other advantages have accrued. Company commanders now retain and exercise operational

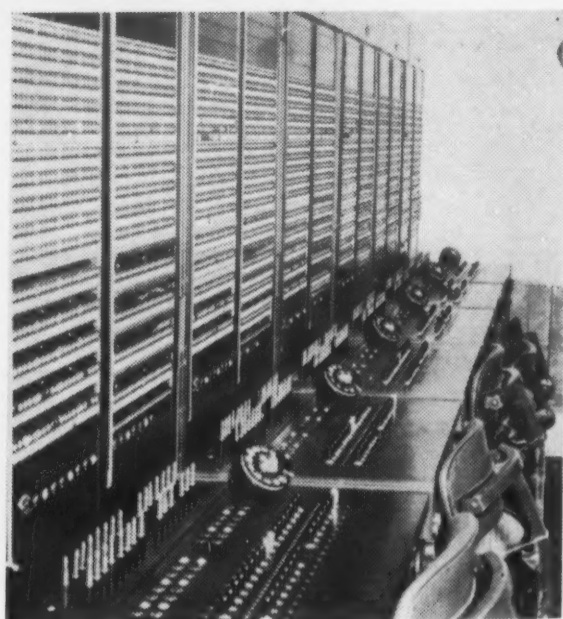


Fig. 1. Six-position switchboard van.



Fig. 2. On-line top relay van.



Fig. 3. Facilities control van.

control of the members of their units and unit integrity is maintained. Platoon leaders now employ operationally the personnel which they, themselves, were responsible for training. Furthermore, they depend operationally on the equipment which they, not another platoon or company, have been maintaining. As previously indicated, it was formerly necessary to utilize some of these same platoon leaders as assistant operations officers under the control of the Battalion S-3, removing them from their primary interest, their platoons, assigning them responsibilities for which they had not been trained and subordinating them to two masters, the S-3 and the Company Commander. By virtue of assignment to the same company, elements such as the Radio Relay Platoon (VHF) and the Carrier Platoon live together and train together, under the same leadership, thereby improving their mutual relationship and the teamwork on which they must rely. The same is true of the other elements between which extraordinary cooperation is essential: Message Center and Teletype, Message Center and Cryptography, and Teletype and Cryptography. The necessity for team integration under pressure and in a short time is obviated. This disintegration of companies resulted in the battalion possessing the only integrity at a particular geographical location such as a command post, with the result that battalion-level housekeeping was required to be performed by a composite headquarters commandant organization under the control of another officer removed from his normal activity. This responsibility now resides with the company commander who is providing the communications support mission at that command post, a much more efficacious solution.

It would be very difficult to secure agreement on a single factor or objective as contributing most to the improved capability of the battalion. Perhaps it is one not yet mentioned, a very important one—esprit and unit pride, the competitive spirit and the morale that derive from unit integrity and daily association in training, operations and relaxation. Major functions have become company missions and personnel have oriented themselves on a unit objective, an important element of sound organization.

#### Communications Mobility

The 17th possessed a degree of mobility considerably less than that necessary to meet the requirements of present tactical concepts. Though authorized a large number of vehicles, some 300 self-propelled and 200 trailers, its mobile capability was primarily of a cargo nature. End items of communications equipment had to be transported as boxes, unloaded and installed in tents. This procedure consumed excessive time, limited flexibility and, despite the shock-resistant capabilities of the equipment, created a real hazard to the "operability" of the items. A sizeable maintenance task could be counted upon.

To overcome this handicap, a positive equipment-mounting program was initiated. Though not yet complete, the program has substantially improved the state of communications mobility.

With the Mobile Signal Center (AN/MSC-5) as a point of departure, wire, radio and communications center facilities have been mounted in 6-ton cargo vans. The principal problems encountered were the design of a layout for maximum utilization of space, without handicap to operations; design and installation of power and communications circuitry which achieved maximum flexibility; mounting equipment in a manner consistent with the "roadability" of the vehicle; maintaining maximum shock-absorbing qualities in equipment mountings and achieving conditions of light, ventilation and heat which would be conducive to human efficiency. Furthermore, this had to be done utilizing tactical equipment, such construction materials and hardware as could be procured under conditions of great austerity and the battalion's own manpower.

#### Examples of Changes

We now have in the "VHF Quad" van, a four-terminal radio relay facility capable of functioning as a double relay. Spare equipment is included and can be patched into a system in minutes. In the switchboard van the three-position telephone switchboard is mounted at one end and the main distribution frame is mounted at the opposite end. This van provides an excellent displacement or alternate telephone switching facility. A six-position switchboard appears in Figure 1; its distribution frame is mounted in a separate van, complete with testing facilities. Included in the MSC-5 are two telephone and telegraph carrier equipment vans, each with a capability of four telephone and five telegraph carrier systems, considerably less than the usual carrier requirement at a single command post. These now are supplemented with three cargo vans in each of which six telephone and four telegraph carrier systems have been mounted.

Not yet completed is a Tape Relay van being built to provide an unclassified teletype relay facility on wheels. The van has been wired so that equipment can be switched between circuits by means of an internal patching facility. A total of twenty-four unclassified circuits can be terminated and a single teletype tape can be reproduced in four copies simultaneously. The AN/MSC-5 provides one Tape Relay van but two are required, one for each of the command operations companies; in addition, the layout in the AN/MSC-5 van provides less efficient working conditions than will exist in the locally fabricated van, on the basis of local experience. The classified counterpart of the Tape Relay van appears in Figure 2, the On-Line Tape Relay. A total of four such vans have been built, each with a capability of eight on-line cryptographic teletype circuits. The need for this facility derives from the great emphasis on the use of on-line cryptography in lieu of separate encryption. The increased speed with which classified messages can be automatically encrypted as they are transmitted, an indisputable advantage, has practically obsoleted separate encryption at higher headquarters. This heavy on-line cryptographic

(Continued on page 40)

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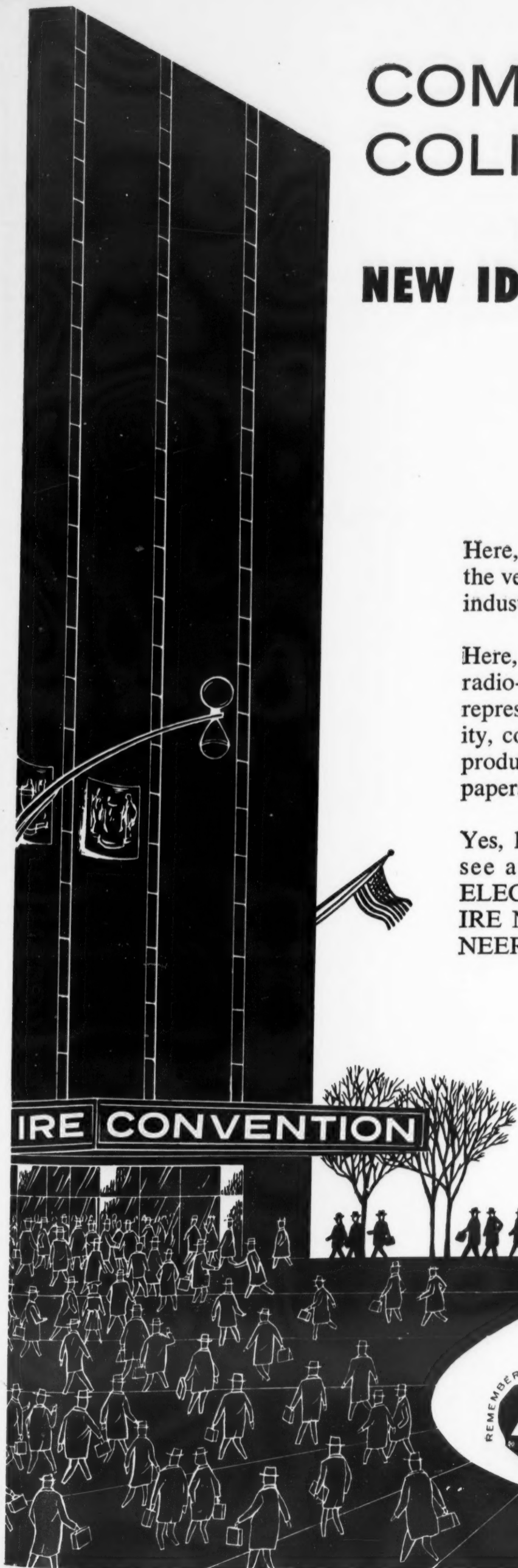
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## air force uses of space

by **BRIG. GEN. H. A. BOUSHEY, USAF**  
**Director**  
**Advanced Technology,**  
**Headquarters, USAF**

**T**HE OPENING SENTENCE of the National Aeronautics and Space Act states, and I quote "... it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind." There can be no doubt as to the desirability of such a national policy—one which is devoted to peaceful ends. But just what exactly is meant by peaceful? What space activities should be classified as *unpeaceful*?

Are all military uses of space *unpeaceful*? I doubt it. Yet somehow the term *military* carries an implication opposite to that of the term *peaceful*. Let us examine this rather strange, and I might add very recent, confused connotation.

In the United States our military forces exist solely to maintain the peace. We have no aggressive motives; we do not covet the possessions of any nation. The slogans of our Armed Forces describe this basic element of U. S. policy. Phrases like "Aerospace Power is Peace Power," though some may think them trite, are nevertheless true.

Let us not permit, therefore, the term *military* to degenerate into a sort of synonym for *unpeaceful*. The evidence supports quite the opposite. Most probably World War II occurred only because the United States, England and France allowed their Armed Forces to deteriorate almost to the vanishing point. Contrarywise, I imagine whatever peace we've

enjoyed since World War II has only been secured by virtue of our considerable military wherewithal. Thus, I believe our national requirements can be summarized by the following three statements:

*First*, we as a nation are dedicated to peace and peaceful means.

*Second*, space, therefore, should only be used for peaceful purposes.

*Third*, a strong military capability, which would be a threat to no nation, supports peace.

The first two points, I expect, are rather generally accepted. The statement that a strong military force, and especially that portion which includes a military space capability, may very well be questioned.

Let me develop a few points leading toward an answer. By law—that is, by the so-called Space Act of 1958—the Department of Defense is charged with responsibility for developing and providing our required military space capability.

Approximately two months ago, the Secretary of Defense assigned virtually full responsibility for military boosters and their launching to the Air Force. Such assignment entails an additional responsibility to respond to the military needs of our sister service with respect to space matters. Further, I believe the Air Force, within its over-all budget, will be expected to program and support a strong military space effort.

But fundamentally, WHY? Is there really a valid case for the mili-

tary to engage in space operations? This is an honest question. It has been asked by sincere citizens; it has been partially answered in the negative by critics of the military, and I think it should be discussed clearly and frankly by the military.

First, let's agree that space is not a function—it is a location, and a location moreover, which cannot be clearly defined. For example, there is no sharp dividing line between the atmosphere and space. Depending upon the authority quoted, the "in-between region," where the atmosphere is "too thin to sustain aerodynamic flight," and space is still too dense to permit true orbital rotation, begins at an altitude of somewhere around 50 to 75 nautical miles above the earth. The true emptiness of space is not reached prior to an altitude of 100 to 125 miles.

Since space is a location, albeit a rather vaguely defined one, then it logically follows that any proposed use of this new location should be evaluated against other ways of accomplishing the same military job in other locations. For example, a military need certainly exists for better long distance communications. There are many ways this can be achieved. Long range radio, under-the-sea cable, satellite relay stations, or even earth-moon-earth radio bounce techniques might be utilized. Each will possess peculiar advantages and disadvantages and these must be compared before any choice, or combina-

tion of choices is made. In other words, new techniques, which operations in space now make possible, must be considered in relation to traditional military missions. Each proposal to utilize space for military purposes must be critically examined to see if there are clear advantages which will justify the large effort and cost.

### *Communications in Space*

Traditionally and historically, military leaders have asked these questions. What are the intentions of a potentially hostile nation? Will we have any warning of attack? How can I assure myself of reliable communications?

The use of space can assist in answering all three questions. Let me discuss them in reverse order and describe only three specific space systems.

#### *The Communications Satellites*

I list this first because the need for military communications has been well recognized for thousands of years. Every method of communication has some disadvantage or drawback. Underseas cables are expensive and vulnerable to sabotage and fishing trawlers. Microwave relays are only line-of-sight devices. They are also vulnerable. Low and high frequency radio is subject to interference and jamming, to solar activity and, most important, to nuclear space detonations and disruption by the so-called Argus effect.

For military communications, space provides many unique advantages. There are at least four distinct classes of communications satellites. The simplest is the so-called passive reflector. By use of a large rocket booster, a body having a surface which can reflect radio signals can be placed in orbit. Any two points on the earth's surface which can see this orbiting body can communicate. And if the altitude of orbit is high enough so as to encounter virtually zero aerodynamic drag, such a satellite could stay in orbit indefinitely. The National Aeronautics and Space Administration (NASA) has responsibility for this type, the passive communications, satellite system.

One program undertaken by NASA considered the use of a balloon with a metalized reflecting surface. When the payload reached the vacuum of space the balloon would be inflated. This experiment was successfully demonstrated the evening of October 28th, when the NASA, firing from Wallops Island, placed a 100 foot diameter balloon at an altitude of

over 250 miles. Perhaps many of you saw this magnificent sight. At that altitude, even though the earth's surface had long ago experienced sunset, the ten story high balloon reflected the sun's rays with spectacular brilliance, and was visible for hundreds of miles along the entire mid-eastern coastal region.

Its great advantage lies in its simplicity. Once inflated in orbit, there is nothing which can go wrong. There are no tubes to blow-out, no batteries to fail, no transistors to malfunction, no antenna to stabilize. Even if it were punctured by a meteorite there would be no change. In the vacuum of space it is planned to allow all the vapor which was used to inflate the balloon to escape in a controlled manner. Thus, if the balloon were later struck by a meteorite, escaping gas would not act as a small rocket jet to alter its orbit.

In space, a balloon of non-elastic material does not need air to remain "inflated." Internal gas pressure is not required. So, it makes sense to deliberately depressure the balloon rather than risk a puncture at some unknown date, with possible gas leakage and random skewing of the satellite to some modified and perhaps undesirable orbital condition.

But there are also disadvantages. Power requirements are high. The reflected signal could be picked up, by a hostile force, over a broad area. Further, an enemy could also use it as a reflector for his messages. But notwithstanding, the passive communications satellite is very attractive—because it is cheap and, above all, reliable.

Another type of communications satellite is the delayed, tape recorder and transmitter type. This is the method which was used to broadcast the President's message about a year ago from an orbiting ATLAS. If a satellite of this type circled the earth at 500 miles altitude, it would require about one hour and a half for each revolution. A message could be sent from a ground transmitting station in "electronic fast time," stored on the tape, and, when the satellite passed near the intended receiving station, the message could be "squirted down," again in "electronic fast time." Depending on the orbital plane, and the locations of sending and receiving stations, minutes, or more likely, hours would be required for delivery of a message. By placing more than one such satellite in orbit, and by varying the planes of inclination, it is probable that communications between any two locations on the earth could be trans-

mitted in less than 30 minutes. However, in today's state of world tension, and with intercontinental ballistic missiles requiring only 30 minutes from launch to impact, time delays as short as only 5 or 10 minutes would probably mean that only low priority traffic would be routed via this means. But this is not to say this system would be ineffective. Quite the contrary! Any means of alleviating our over-burdened military communications networks is sorely needed.

The third class of communications satellite is the relay type. It can relay messages without any appreciable time delay between any two points, each of which can see the satellite. It would be particularly useful for positive control of both airborne and ground based units of our Strategic Air Command, for naval units at sea, and command control of overseas Armed Forces. If located at 22,000 miles altitude, the angular orbital rate of such a satellite would exactly match the rotation of the earth. Directly above some point on the equator, a stationary satellite would remain at the "high-noon" position. And figuratively, it would "hang there" day or night—sunrise or sunset. Three of these, spaced 120° apart could cover most of the globe, and with lower altitude, polar satellites could provide an instantaneous and truly global military network.

#### *The Early Warning Satellite*

The principle underlying the second class of military space systems, called MIDAS, is very simple. In space, there is no attenuation of radiant energy because of moisture, gas, or dust particles. Thus, infrared detection devices can sense over great distances. When a ballistic rocket rises from the ground and climbs to an altitude of about 40 or 50 thousand feet, it is then well above most of the atmosphere and the vapors it contains. A MIDAS type satellite, looking down through only a small percentage of the atmosphere should be able to "see" the fiery rocket plume of the ballistic missile. MIDAS would then send radio alarm signals. By such means the available time for warning of intercontinental ballistic missile attack might be doubled. There should be no question of the military need for this MIDAS space system.

We all recognize that a burglar alarm is a peaceful device. Likewise, a watchman is peaceful, and has often been referred to as the guardian of the night. We even provide watch-

*(Continued on page 21, col. 3)*



Bell Telephone Labs., Inc. photo

# DO WE HAVE A SPACE PROGRAM?

by DR. WILLIAM H. PICKERING  
Director, California Institute of Technology  
Jet Propulsion Laboratory

IF WE LOOK AT THE history of the past two years, it is apparent that the United States reacted violently to the first Russian Sputnik with the assertion that we would now establish our own space program and that we would very quickly equal the achievements of the Russians. Since that time, as we all know, the NASA and the ARPA were formed to set up a U. S. space program—but it seems that every time there is another Russian shot the question is still asked, “Do we have a space program?” Also, “When are we going to catch up with the Russians?”

Now, if we stand back and ask the first question without regard to any other facets of world history, the answer is obviously, “Yes.” There is a sum of money on the order of half a billion dollars a year being spent on such a program, so we must certainly conclude that the United States does, in fact, have an active space program. I think the question which we really need to ask is not “do we have a space program” but “do we have the *right* space program.” In order to answer that, we must ask ourselves, “What are the ground rules by which we determine what is the right space program?”

Back in pre-Sputnik days before the cold war campaign in outer space, we had an IGY space program. I think that most scientists associated with that program visualized it as being a program with relatively few shots of space vehicles having payload capacities measured in the few pounds (or perhaps few tens of pounds). I think they visualized this state of affairs as existing for a few years, and then gradually evolving into large space vehicles, lunar exploration and planetary exploration. Only a few enthusiasts were concerned with the rate of advance of our space capability and with the rapid development of large space vehicles.

Sputnik immediately changed the picture, but the very hysteria engendered by the first Russian space shots encouraged us to listen to the most wild-eyed visionaries with the result that as far as the public was concerned they were expecting miracles in the area of space technology

almost overnight. They do not realize the real costs or the time factors in the campaign to be waged, and therefore they become more confused and disheartened as time goes on.

Shortly after Sputnik, Dr. Killian's committee presented a Space Primer, in which four objectives for space exploration were presented. These were, in brief, 1) scientific, 2) commercial, 3) military, and 4) human objectives. Now, it would appear to me the Killian Space Primer omitted the most important objective, and that is, simply, the objective to equal or exceed the achievements of Russia in space. In other words, we should frankly admit that we are indeed in a race with the USSR.

If it is a race, one can ask the question, “For what are we racing?” Is it for military domination of space? Is it for scientific discovery? Or for commercial exploitation of space? Or is it for our national stature and prestige in the world? I believe the last reason is the most important, and not by any means solely for reasons of nationalistic pride but rather for very hard-headed, economic reasons.

For much of the Twentieth Century, the world has looked at the United States as being the leader in technology and in engineering. At this time, to much of the world the question is now: “Is it Russia, or is it the United States which is the technological leader?” As a consequence, many decisions affecting our economic welfare are being made against a background of USSR achievement and development in this area.

As far as the rest of the world is concerned, it is perfectly clear that we are in a space race with Russia; we have clearly stated that we are undertaking space developments and space exploration. It is also clear that in the post-Sputnik era we have not within these two years succeeded in matching Russian achievements.

We must either pursue our space developments actively and successfully or we must declare ourselves completely out of the space race.

Viewed in this framework, it appears to me that the U. S. space pro-

gram must be written with the following ground rules: First, the U. S. public must understand the importance of our space program, the time and effort required to conduct the program, and the fact that miracles will not occur overnight. Secondly, we must establish national objectives clearly to set up a mainstream of dramatic achievement as well as a broad base of exploration and exploitation. Finally, we must establish the management and the funds to properly support, on a long-term basis, our real national objectives.

Within this framework of space objectives, then if you ask, "Do we now have a program?" the answer must be, "No." In the first place, I believe there is a lack of public understanding of the significance of our space program, of the necessity for the program, of the objectives of the program. There is public confusion as to the results of the program, and even of what we should be trying to do. Does the public think we must establish a base on the moon? Or do they think we are trying to do a cosmic ray experiment? Or are we just copying everything the Russians do? Or, indeed, should we have a military space program, a civilian space program, or both?

I believe there is, also, a lack of broad governmental understanding of national objectives. The questions of the relative priority of military and civilian programs are not clear; and, indeed, inter-service and inter-agency rivalry for scarce funds, facilities and manpower, is certainly occurring.

At this time, what can we do to rectify the situation? As a nation, I think that we must establish our long-term goals in our own space exploration program and then quit jumping every time the Russians fly another space experiment. We must establish goals which are susceptible of engineering achievement and which will provide significant and dramatic progress in space. Then, it is also necessary for us to clarify management responsibilities and priorities in our space program. We do not necessarily have to have a single space program, but we must clearly understand in what areas we can afford the luxury of parallel approaches and peripheral projects. As individuals, as professional engineers and scientists, it appears to me that our task is to educate the public and Congress to the realities and the needs of a national space program, not

only to the technical realities of space, but also to the realities of the time and money required to accomplish results. Then, of course, we must with patience and understanding encourage and support those who are actively working on the program. It is always difficult to be in second place in this kind of contest, particularly when our every move is made in clear view of our opponent. Success will only come as a logical consequence of public understanding, public support and hard engineering achievement.

This public understanding, it seems to me, is imminent. There are increasing signs that the public is vaguely discontented and embarrassed by our position in the space race, and that it soon will make its voice heard.

A Los Angeles newspaper, the *Mirror News*, for example, undertook a public opinion poll last month in which it asked its readers to reply to a 10-point questionnaire and mail it in to the editorial offices.

In the first week, more than 2000 readers went to the trouble of filling out the questionnaire and mailing it in. This is 40 per cent in excess of the response to a similar survey undertaken by the same publication on Los Angeles smog, and I think most of you know the public opinion rating of smog in Los Angeles.

In the returns, three out of every four persons said they are "ashamed" of our position as opposed to Russia in the space program, and six out of every 10 said they wanted the U. S. to catch up even if it means reducing our standard of living.

Most significantly, more than 50 per cent said they are willing to pay an additional \$50 a year or more in income taxes—if the money is allocated directly to the space effort.

A majority agreed that the main danger in lagging is that other nations will decide that Russia, not the U.S., is the nation to copy.

To all of us, this should be encouraging news. It means that the people of this country, who are in the end charged with the responsibility, have awakened to the danger inherent in this Cold War, and they are about to ask that something be done.

When this occurs, I think, our troubles will disappear and our programs will fall into place.

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*Based on a talk given at the 14th annual meeting of the American Rocket Society.*

## Air Force Uses of Space

(Continued from page 19)

men with arms to assist them in their tasks. Thus, it seems to be the intent more than the weapon which determines what is and isn't peaceful.

In a similar manner, a satellite could warn the free world of an oncoming ballistic missile attack. In fact, the MIDAS system, as you undoubtedly know, is designed to do just that. This function is analagous to that of a burglar alarm, and is peaceful, although such a satellite must be classed as a military device.

### *The Reconnaissance Satellite*

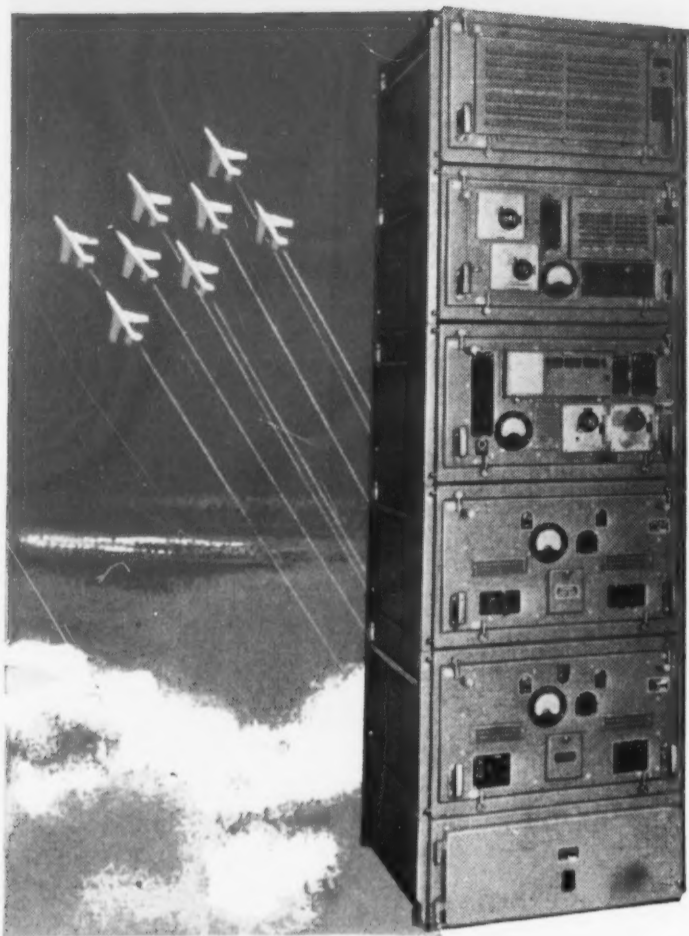
SAMOS, as you know, will be our reconnaissance satellite. It can probably give a reasonable answer to the question, "What are the intentions of a potential enemy?" It can do this by furnishing information concerning a possible mounting military threat which we can obtain in no other way.

I have spoken exclusively of the military needs of space, and obviously, from the Air Force viewpoint. I believe it proper that I should. But lest I leave a wrong impression, let me assure you that the Air Force strongly supports scientific exploration into space. The NASA is the agency charged by law with that responsibility and the Department of Defense cooperates fully in NASA undertakings. Obviously each can contribute to the other, with a resulting benefit to both.

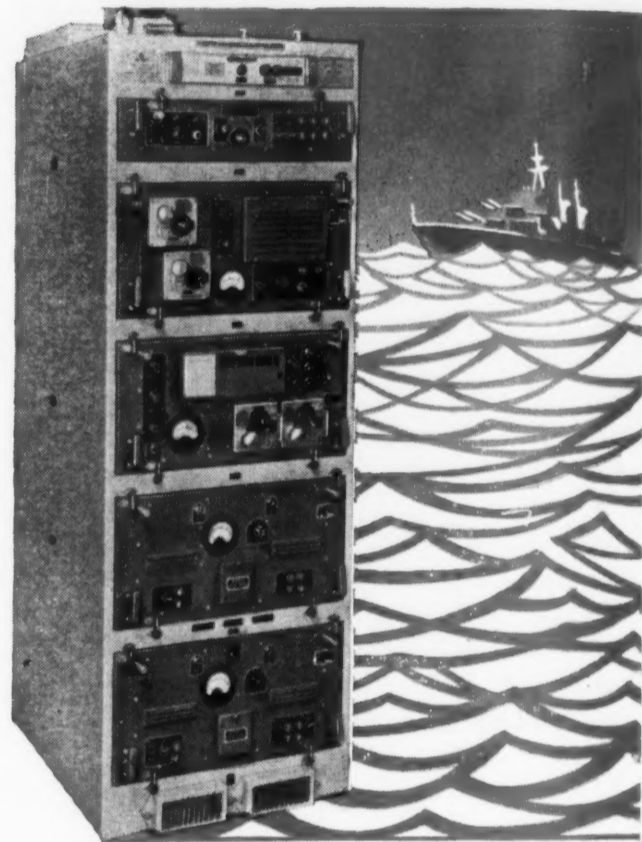
In conclusion, I must return to the critical question. Is there a real need for military space operations? The answer is an emphatic YES! A military space capability must be developed and maintained as a matter of urgency for our national survival. There are unique advantages to the use of space. Military space systems are not unpeaceful. They can promote the cause of peace—and in many areas can do it more effectively than any other device. I think of military space systems as "burglar alarms" or the "policemen of space." They are not a threat to the peaceful world citizen anywhere. Further, I believe that military satellites and space weapons, at least for the foreseeable future, will primarily assist the defender, and will be of relatively little value to a would-be aggressor. This situation is indeed fortunate.

A military space capability second to none is mandatory to the future security of the United States. And I believe a vigorous military space program will, more than any other one endeavor, promote world peace.

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by C. F. JENSEN  
Marketing Manager  
"RAYESCENT" Lamp Department  
Westinghouse Lamp Division  
Westinghouse Electric Corp.

THE PHENOMENON OF electroluminescence has been known for a good many years but it has only been in the last few years that concentrated effort and manpower have been devoted to exploiting the many possibilities of this exciting light source for the future.

Much has been written about luminescence but not too much about electroluminescence, one form of luminescence. The following table provides a review of the forms of luminescence and the various means of excitation.

Type of Luminescence	Exciting Sources
Photoluminescence	Visible Light or Ultraviolet
Roentgenoluminescence	X-Rays
Cathodoluminescence	Cathode Rays
Ionoluminescence	Ion Beams
Radioluminescence	Alpha or Gamma Rays
Triboluminescence	Mechanical Action
Chemiluminescence	Chemical Action
Electroluminescence	Electric Field

Electroluminescence differs substantially from previous sources of light in that light is generated in a solid material by the application of voltage to the material. In effect, this is a direct use of electricity rather than indirect, as in the case of in-

candescent or electric discharge types. In the incandescent lamp, light is a result of the high temperature generated by the resistance to the flow of electricity. With the fluorescent lamp, a form of gas discharge lamp, a little of the light is generated by the arc but most of the light emanates from the phosphor, on the bulb wall, which is activated by the ultraviolet generated by the gas discharge.

Electroluminescence, however, does not depend on heating nor upon a gas discharge for its light output. No bulb is needed and no vapor is present; the light can be produced in a film, a few thousands of an inch thick. In electroluminescence, light is generated by phosphors excited by an alternating electric field produced by an applied voltage. Applied field strengths produced are about 100,000 volts per inch. The scientific theory used to explain electroluminescence is based on solid state physics. The phenomenon of electroluminescence was first discovered by Professor Georges Destriau of France in 1936. In the "Destriau Effect," particles of a suitable powdered substance, or phosphor, were suspended or embedded in an electrical insulator, or dielectric, and an intense alternating electric field applied to the combination. Under such excitation, the particles became luminescent. The light produced was extremely low in brightness, in the order of .001 foot-lamberts. Later work produced higher brightness in the order of .01 foot-lamberts. Today, a brightness of 1.5 footlamberts is easily produced in a

glass plastic lamp with only 120 volt, 60 cycle excitation. In fact, at our laboratories, we have produced brightnesses in excess of 2,000 foot-lamberts, at higher voltages and frequencies.

Electroluminescent lamps can be made in many ways and in many forms. However, most of the lamps being made and experimented with today are of the "sandwich" type where one electrode is transparent and the other is generally opaque or translucent, with the phosphor sandwiched in between.

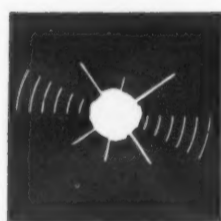
One method commonly used today is to coat a metal plate with a white reflecting enamel (one electrode), on this is applied a layer containing phosphor, on top of this is placed a thin transparent conducting layer, as the second electrode, and then a transparent layer. Since this combination is fired to form a ceramic sandwich, it is generally known as a "Ceramic" or enamel lamp. The electrical connections to this lamp are made from the front side. The brightness of ceramic lamps is generally lower than glass plastic type lamps.

Another type of lamp is made by coating a glass with tin oxide or other suitable transparent conducting material. This conducting material becomes one electrode. A layer of plastic containing the phosphor is sprayed or painted on this coating. The glass and plastic are heated to set the plastic and then a layer of aluminum or other metal is vapor-

(Continued on page 39, col. 2)

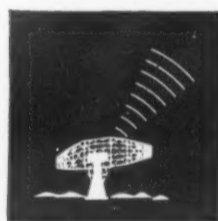


## space power problems?

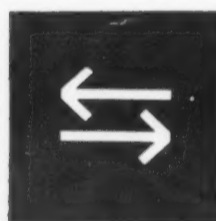


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RADAR



COMMUNICATIONS



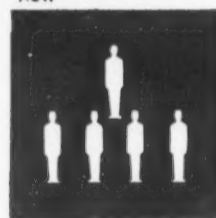
ASW



ELECTROMECHANICAL



SOLAR POWER



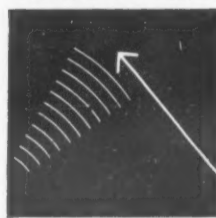
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# Measuring Microwaves at Natural Level of Frequency and Power

by Samuel Freedman  
President  
Chemalloy Electronics Corp.

THE FUNCTIONING RANGES of modern microwave tubes and associated radar systems require especially safe and efficient facilities for power measurement and absorption. These ranges have reached frequencies as high as 75,000 megacycles, with average powers already in the neighborhood of 50,000 watts and peak powers of 20 megawatts or more.

These conditions have led to the use of liquid loads or transducers operating "dominant mode" correct for each frequency band and functioning at the full natural level for the energies involved. It is making possible those tasks that otherwise would be difficult, if not impossible, to achieve with ratio, sampling, transition or cumulative heating devices.

Some microwave stations use modern calorimetric techniques when the transmitting frequency and power are great. Some situations where these techniques are necessary include:

- (1) Where radiated energy poses a hazard to surrounding personnel.
- (2) Where the cumulative heating effects of RF energy will damage dry or static loads and absorbing mediums.
- (3) Where the VSWR (reflection coefficient) has to be extremely low and good matching must exist to safeguard costly tubes, other components, or waveguides against electrical breakdown or thunderous arcing.
- (4) Where equipment must be tuned under full load without space radiation.
- (5) Where power must be measured to typical accuracy of  $\frac{1}{2}$  of 1% to 2%, as compared to plus or minus 2 db (about 38%) of many non-calorimetric measuring techniques that lack definite relationship between the components and the wavelength or energy mode.
- (6) Where a standard measuring device is needed that is free of circuitry, tubes, or energy consumption so that malfunctioning of this device from circuit failure may be avoided.
- (7) Where operation must be simple enough to permit use by personnel with minimum experience or qualifications.

## An RF Calorimeter

A calorimeter is both a precision RF wattmeter and a highly efficient dummy load. Any level of average power can be absorbed and measured without regard to its peak or fluctuating energy values. Such an apparatus may be known by various names such as "calorimetric wattmeter," since it measures power in watts; "caloric meter" or "calorimeter," since it can measure RF energy as liquid heat in calories; "dummy load," since it absorbs power; "microwave or waveguide calorimeter," since it may be used with water loads terminated in a waveguide or as a "coaxial calorimeter," since it can be used with a water load terminated in a coaxial cable. These can all be the same instrument.

A calorimeter functions as a simple means of circulating selectable known rates of liquid flow through a suitably designated low VSWR Load that will accept RF energy by control and determination of flow rate and liquid temperature rise for any level of power. Since flow rate of water in

cubic centimeters per minute multiplied by the temperature rise of the liquid in degrees centigrade directly computes to calories per minute, this flow rate can be used to measure power accurately either in calories or watts (14.334 calories per minute is an absolute watt of power). It can be calibrated directly in watts—by position of float of a flowmeter, for example. If the liquid employed is other than water, then the apparent caloric count is multiplied by the specific heat of such fluid to determine true power. Since water is plentiful and essentially costless, and has unity specific heat, it is the most common fluid used in calorimetry.

Figure I illustrates details of a calorimeter system capable of both measuring and absorbing the power of any radar system. Liquid enters from a water tap or reservoir source and proceeds to a combination water pressure reducer and stabilizer. In modern units this is normally single control. Some systems may have dual control (one coarse and pre-set while other, in tandem, is vernier and adjustable). A three control system would additionally have a toggle valve to provide "zero flow." The single control version can both regulate and reduce to zero. The liquid then continues through the flowmeter to an input thermometer, where its temperature is measured before RF exposure; then it continues through a snap-on fitting to an RF load terminating inside the waveguide mated to a radar energy source. The RF energy is absorbed by the water in the load, which in turn undergoes a temperature rise. This heated water then continues back to the other snap-on fitting of the calorimeter and on to the output thermometer, where its temperature is measured after RF exposure. All information necessary has then been obtained—namely, flow rate and temperature differential. The liquid may now be expended; or it may be returned to a reservoir for storage, recooling, and reuse.

As long as the liquid flow and the power absorbed are unchanged in magnitude, the temperature differential will be constant. It will only be cumulative if the flow is stopped or becomes very low for the power involved. For a power of 10 watts, corresponding to 143 calories a minute, a selected flow rate of 100 cc/minute (where 3785 cc is a gallon) would cause a liquid temperature rise of 1.43 degrees Centigrade. For 1000 watts, a flow rate of 1000 cc/minute would lift the temperature 14.334 degrees centigrade. Figure 2 illustrates a single control calorimeter suitable for measuring up to 5000 watts average power, at which point the flow rate might be 2000 cc/minute involving a liquid temperature rise of 35.8 degrees C. Figure 3 illustrates a higher power version, capable of measuring 50,000 watts, at which point a flow rate of 25,000 cc/minute (6.6 gallons) would cause a temperature differential of 28.66 degrees C. (being 716,700 calories a minute divided by a flow rate of 25,000 cc/minute). In the latter instance, reducing the flow from 6.6 gallons to 1 gallon per minute would convert the water into steam. If the liquid were alcohol (.5 specific heat), the temperature would be twice as great. If it were liquid chloroform (specific heat .2), the heat rise in degrees C. would be five times greater than water for the same power. This is useful only in measuring low power with expanded information; for high power, water with its reduced sensitivity (specific heat 1 or maximum) permits handling of maximum energies without unduly high response indications.

(Continued on page 27)

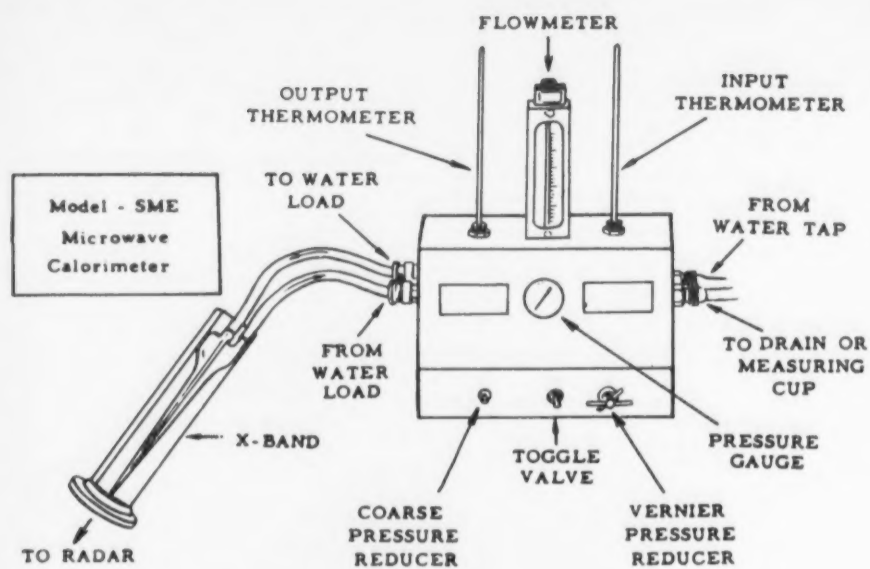


FIG. 1

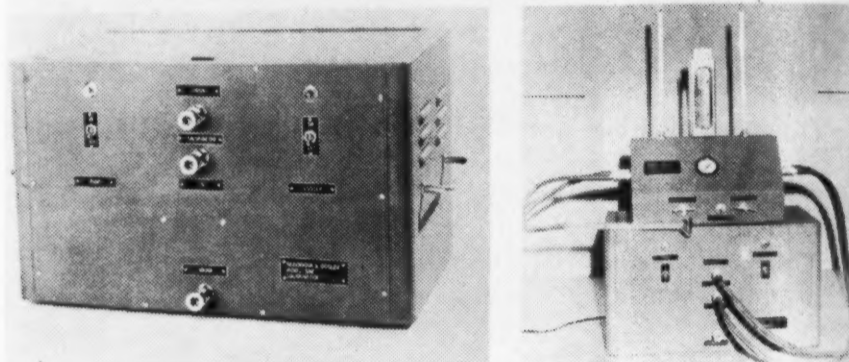
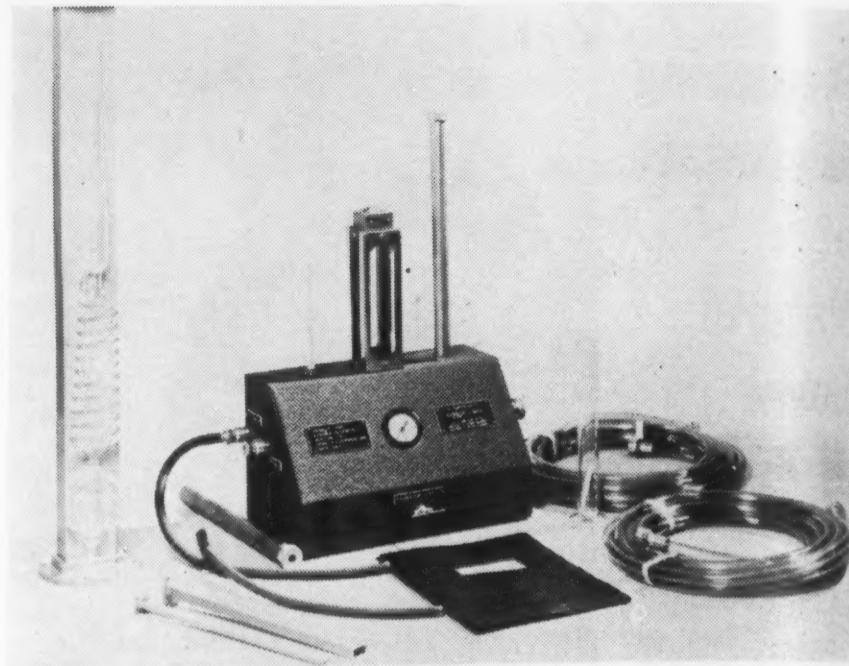


FIG. 2

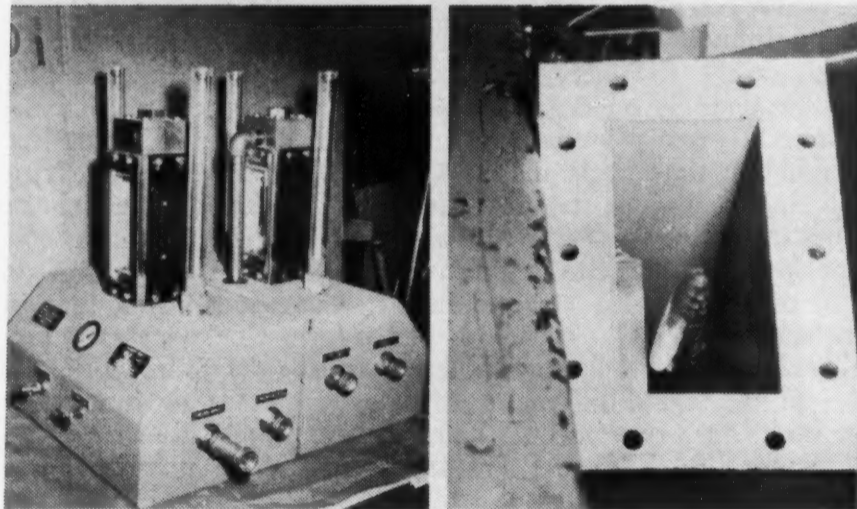
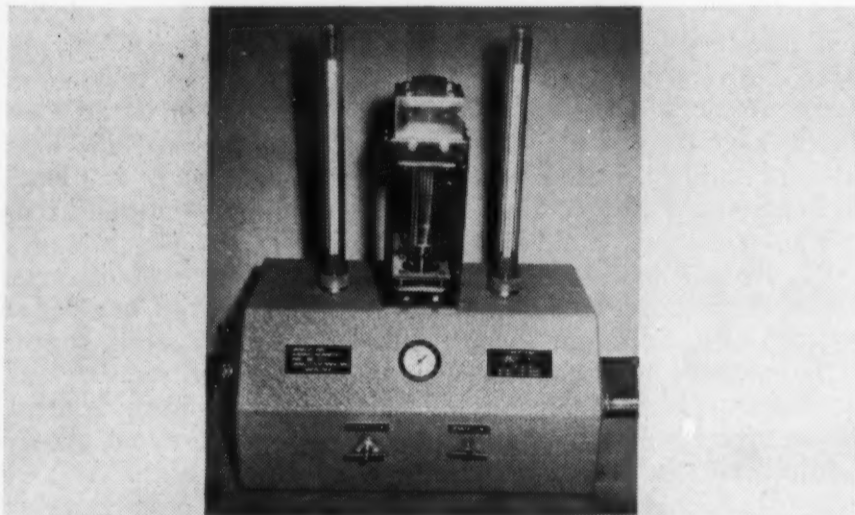


FIG. 3

(Fig. 1) External details of a microwave calorimeter and illustration of how an interchangeable load snaps on to instrument and to radar or other energy source to absorb/measure RF energy. It may be either single control, dual control (with coarse and vernier regulators in series) or triple control (with two regulators and a toggle valve in series). (Fig. 2) Calorimeter suitable for power measurement up to 5000 watts. Below is shown use with reservoir in lieu of water tap liquid source interchangeably. (Fig. 3) High power calorimeter to measure up to 50,000 watts average power. (Fig. 4) RF water loads correct for each frequency band. Coaxial and larger L band counterparts (bottom). (Fig. 5) Three-path high power water loads. Path 1—water entry path. Path 2—relief and escape path for steam and air. Path 3—water exit path.

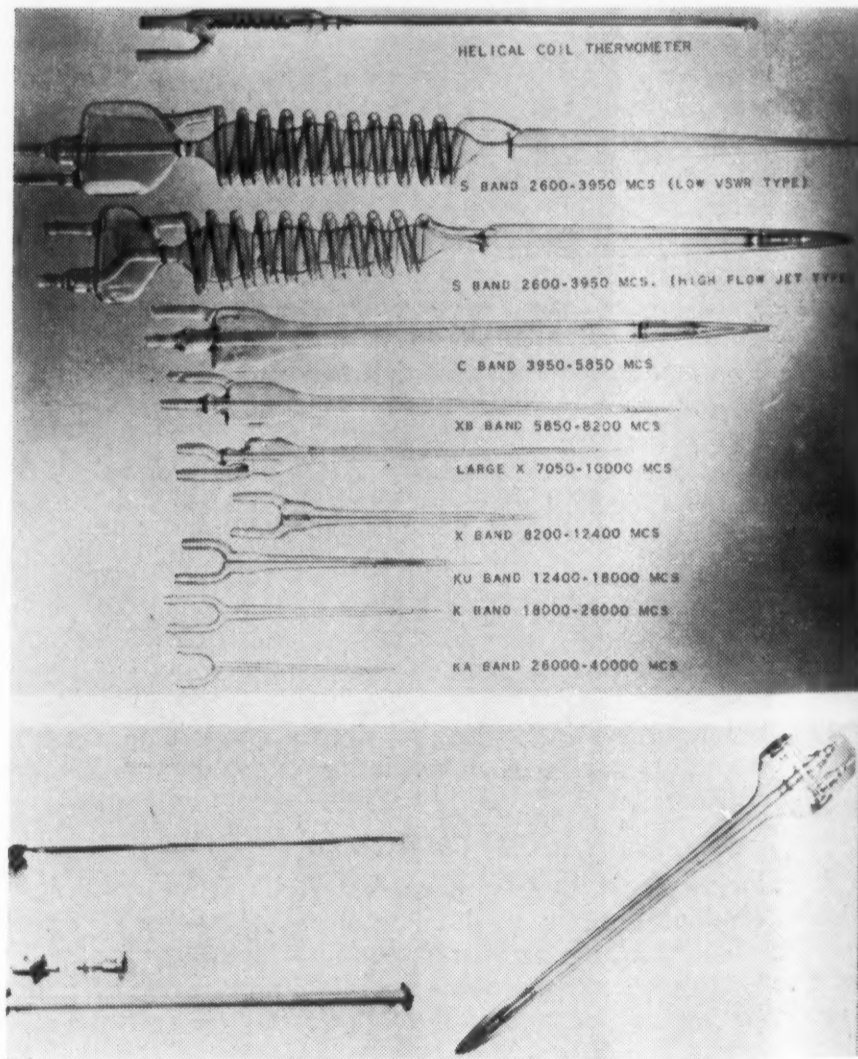


FIG. 4

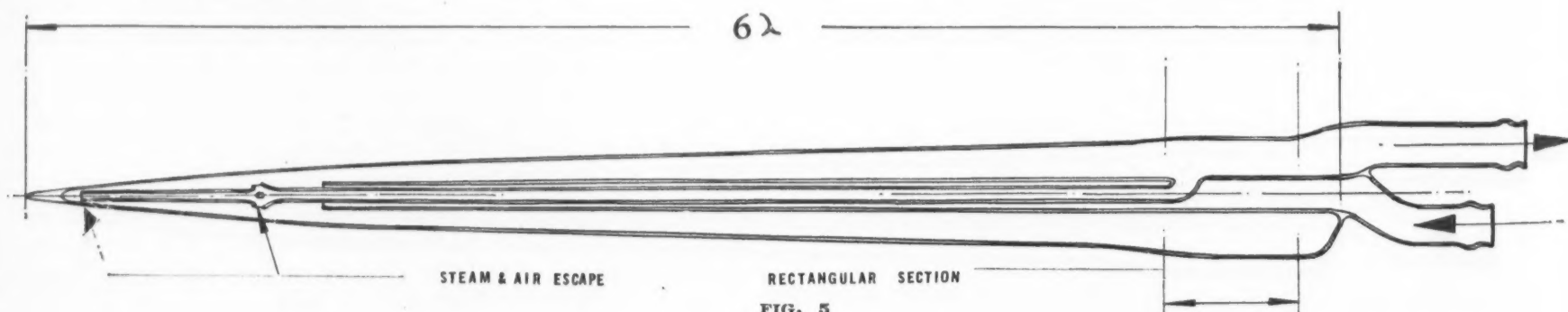


FIG. 5

The time needed to make a measurement is the time needed for water to pass from the load tip to the output thermometer, normally almost as fast as the eye can identify changes. Even for long connections and minimum flows, it rarely takes over a minute.

### Pertinent Design Features

While the concept and functioning of a calorimeter are elementary, this is so only because of high quality loads and thermometers to assure accuracy.

**Load Design:** Figure 4 shows typical loads suitable for microwave calorimetry. In the waveguide version, each load is a double-compartmented glass shape configured from a needle-pointed tip, flaring out to the full i.d. of a waveguide housing in a distance of six wavelengths. The sharpness of the tip and the length of gradual taper decides the VSWR. Loads illustrated have a typical VSWR of 1.025 to 1.04 regardless of frequency band. A blunt tip (sometimes used to permit more liquid flow) or a shorter axial length (necessary at lower frequency bands) lifts the VSWR. These loads connect interchangeably to a common calorimeter via snap-on connections on the instrument. Such a load can absorb about 60 db for all the energy encountered. The load absorbs the power sinusoidally, with each half wavelength from the tip end and absorbing about 90% of the remaining energy.

In the coaxial version, the o.d. of the inner conductor entering the glass envelope is equivalent to the tip of the waveguide load. The hollow center of the inner conductor (which tapers down inside the glass envelope to the far end) serves as water inlet path, with water escaping at its wide diameter just inside metal-glass seal. It then returns inside the glass envelope external to the inner conductor. When such a load is four wavelengths long, the typical VSWR will be 1.2, which includes hardware or copper losses. The VSWR increases as the wavelength is less than four wavelengths long. If saline or resistive water is used, the load operates then with both sinusoidal and resistive absorption methods, thereby permitting its use with low VSWR to much lower frequencies.

When loads are used at very high power, the load inner compartment has relief jets near the tip to permit greater flow at reduced pressure. If peak power is extremely high, the load may be pressurized or sealed in its waveguide, with water connections coming through a gasketed flange plate. If peak power is likely to be high enough to cause internal waveguide arcing, this can be eliminated by off-centering the load tip in the waveguide housing so that the first half wavelength does less of the total absorption.

(Editor's note: Figures 5 and 6 were received from the author as we went to press and their descriptions are inserted here for continuity.)

Figure 5 illustrates a more recently developed three-path (instead of a two-path) load to cope with linear accelerator power levels in the nuclear program. There, energy levels greatly exceed radar levels with longer pulse lengths sufficient to cause water to become steam and normally cause load explosions. The three-path design permits steam to form at the tip and return to water further away as the steam recedes from the tip. Figure 6 illustrates how energy encounters the load sinusoidally.

**Thermometer Design:** At top of Figure 4 may be seen the unhoused helical mercury thermometer complete with Dewar flask. Ordinarily bulb thermometers are unsatisfactory. The helical mercury reservoir sealed within the Dewar flask is designed to (1) be more instantaneous in response, (2) be more nearly complete in response, (3) keep water se-

quence correct (the first water in being the first water out, to assure reading stability, (4) keep water path continuous even down to drops per minute (to permit reading also minimum power), and (5) protect against external temperature influences. The Dewar flask is virtually a Thermos bottle within a Thermos bottle.

The mercury column capillary is backed by a reflecting colored magnifying mirror for its full height to provide (1) color contrast, (2) magnification, (3) directivity to permit every one to read it identically without parallax error and (4) termination atop the thermometer, with overflow reservoir that permits restoration when temperature drops.

Typical thermometer scales are 18-28 degrees C., scaled 50 divisions per degree (primary standards), 10-35 deg. C. scaled 20 divisions per degree (low-medium power) and 10-65 deg. C. scaled 10 divisions per degree (up to maximum power).

### Accuracy of Measurement

Five errors of calorimetry are (1) Flow, (2) Thermometer, (3) Specific heat, (4) VSWR and (5) Heat radiation.

Flow error is resolved by measuring exit water with calibrated measuring cup against that shown by flowmeter.

Thermometer error is inconsequential if both thermometers are similarly aged, use same triple distilled mercury, and are individually calibrated initially to better than .01 degree C., a value which is regularly achieved. Temperature differentials still continue correct even if calibration changes with years of service.

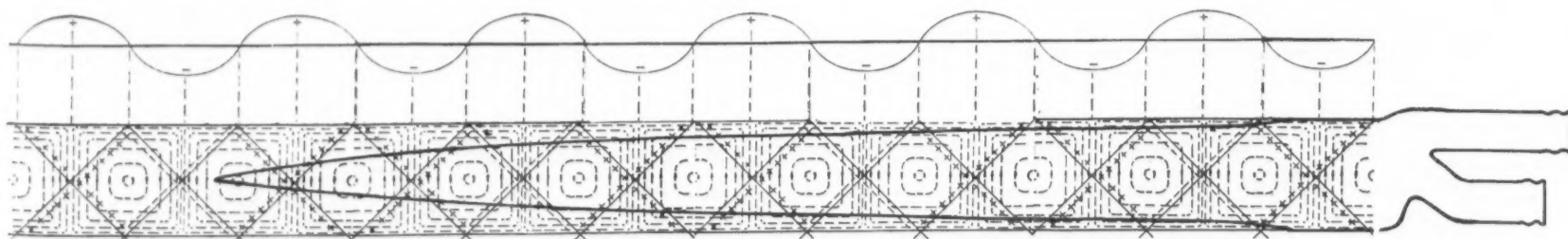
Specific heat error caused by impure water less than 1.0 or unity specific heat causes thermometers to read higher than true. If desired, initially, a power measurement can be taken with distilled water (yielding for example 143 calories for 10 watts), and again with the unknown quality liquid (yielding, for example 145 calories for 10 watts). Then, the specific heat of the unknown liquid to be used is 143/145 thousandths part of 1. The apparent caloric count can be multiplied by this figure to get the count desired.

A typical load with VSWR of 1.03 will have a reflection loss of .226 parts of 1%. This will yield a power reading error about  $\frac{1}{4}$  of 1% less than true. In practice, the specific heat error (reading higher than true) and the VSWR error (lower than true) largely annul themselves as they are approximately equal and opposite.

Heat radiation loss is caused by the cooling down of the water while enroute from the load back to calorimeter output thermometer or external temperature influences. This is negligible when a high flow and low temperature differential is used. If the flow is small, temperature differential great, and connections very long, one needs only to plot power vs. temperature for two or more flow rates and project the graph line back to zero degrees C. which is true power devoid of all heat radiation loss. Limit of distance between the calorimeter and the load termination can then be that where no temperature change is noted between the two thermometers (a mile or more for high power or high flow considerations).

By reverse usage, the calorimeter can serve as its own temperature, flow, specific heat or even VSWR standard, in keeping with the equations of Table 1. (See page 28.)

Apparatus of this type is already widely spotted in the U.S. and Canada in industry and government, for use as primary standards, functional test, quality control, maintenance, and repair tasks. It has reduced error about twenty times percentagewise as compared to non-calorimetric techniques. In the case of high power, it has become the only method available and safe to use.



(Fig. 6) Example of how the water load intercepts RF energy distribution in a waveguide. The load absorbs in sinusoidal manner approximately 90% of the power remaining each half wave length.

TABLE I  
FORMULAS USED FOR CALORIMETRIC DEVICES

- (1) Cubic Centimeters flow  $\times$  Temperature difference in degrees Centigrade = Calories per minute.
- (2) 
$$\frac{\text{Calories per Minute}}{\text{Temp. rise Degrees C}} = \text{flow per minute in cubic centimeters}$$
- (3) 1 Cubic Centimeter of water = 1 gram.
- (4) 1 watt of power = 14.334 calories per minute
- (5)  $\Delta I = W \times C_p \times (t_2 - t_1)$   
 where:  $\Delta I$  equals change in internal energy in BTU  
 W equals weight of water being heated in pounds  
 $C_p$  equals specific heat 1.0 for water  
 $t_2$  equals final temperature of water in degrees Fahrenheit  
 $t_1$  equals initial temperature of water in degrees Fahrenheit  
 Conversion Factors:  
 1 watt equals 3.413 BTU/hr. = .056883 BTU/min  
 1 gallon of water weighs 8.347 lbs.  
 1 milliliter = .0002642 gal. = .0002205 lbs. water
- (6)  $\Delta I = .002205 V (t_2 - t_1)$   
 where V equals volume of water flowing per minute  
 Units: BTU/min. = (lbs./cc) (cc/min.) ( $^{\circ}$ F)
- (7) Converting BTU/min. to watts:  

$$\text{Power in watts} = \frac{1}{.056883} \Delta I = 17.579944 \times \Delta I$$

$$\text{Watts} = \frac{(\text{watts})}{(\text{BTU/min.})} (\text{BTU/min.})$$
- (8)  $I = .002205 V (t_2 - t_1)$  & Power in watts =  $17.579944 \times \Delta I$  therefore:  

$$\begin{aligned} \text{Power in watts} &= (17.579944) (.002205) V (t_2 - t_1) \\ &= .038763 V (t_2 - t_1) \end{aligned}$$

$$\text{Units: watts} = \frac{(\text{watts})}{(\text{BTU/min.})} (\text{BTU/min.}) (\text{lbs./cc}) (\text{cc/min.}) (^{\circ}\text{F})$$
- (9) Power in watts =  $146.718395 V (\text{gallons. min.}) \Delta T (\text{Fahrenheit})$
- (10) Power in watts =  $264.093111 V (\text{gallons. min.}) \Delta T (\text{Centigrade})$
- (11) 
$$\text{Volume in gallons/min.} = \frac{.006815 \times \text{Watts}}{\text{Temperature differential Fahrenheit}}$$
- (12) 
$$\text{Volume in gallons/min.} = \frac{.003786 \times \text{Watts}}{\text{Temperature differential Centigrade}}$$
- (13) 
$$\text{Temperature differential } ^{\circ}\text{F} = \frac{.006815 \times \text{Watts}}{\text{Gallons flow per minute}}$$
- (14) 
$$\text{Temperature differential } ^{\circ}\text{C} = \frac{.003786 \times \text{Watts}}{\text{Gallons flow per minute}}$$



—GOVERNMENT—

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION will launch the first "Project Echo" satellite next spring. "Project Echo" calls for launching an aluminum-coated sphere into a 1000-mile altitude earth orbit, moving in a northeasterly direction from the Atlantic Missile Range with an inclination of about 50 degrees to the equator. After the sphere is placed in orbit, NASA hopes to establish two-way radio communications between the east and west coasts of the United States by bouncing signals off the sphere. It is believed that the aluminum coating will provide the sphere with radio wave reflectivity of at least 98 percent up to frequencies of 4000 megacycles per second. NASA stated that it was making an exception to its policy of not publicly announcing space experiments until they have been performed, so that scientists in the communications field who could make constructive use of experiments involving the sphere would have sufficient advance notice to make technical preparations.

ARMY AVIATION NEEDS were presented recently to approximately 100 aircraft and electronic firms who will try to work out new aviation design concepts to meet Army long range aviation plans. At the Dec. 1 meeting conducted by representatives of the Office of the Chief of Research and Development, the Army Transportation Corps, Signal Corps and the U. S. Continental Army Command, Army planners listed three areas in which new types of aircraft not now available may be needed in the next 10 years. The areas are: light observation aircraft with a wide array of performance capabilities close to the battlefield, surveillance aircraft heavily instrumented with electronic detection devices and highly-mobile transport aircraft built to operate in battle areas.

NAVY AIR WEAPONS MEET (COMPETITION) featured 130 planes from the Navy's frontline operational units using air-to-air rockets and missiles in the competitive training exercise, which was conducted to provide the Navy an opportunity to evaluate its aviation weapons systems, supporting equipments and training and operating techniques. Operation "Top Gun" marked the first time the Navy used a remote-controlled, free-flying high performance jet target in major weapons meet action. Winners of preliminary competition at their home bases, 17 Navy and Marine aviation teams from Atlantic and Pacific Fleet squadrons competed in the exercise November 30 to December 4, at Yuma, Arizona.

NATIONAL INVENTORS COUNCIL, DEPT. OF COMMERCE is looking for solutions to some 300 technical problems which it recently released. The problems present challenges in almost every field of science and technology. Acting as liaison agency between the Armed Forces and the nation's civilian inventors, NIC advises civilian inventors of problems standing in the way of national defense development, evaluates proposed solutions from the inventors and turns promising ideas over to the proper military agencies. Copies of the problems may be obtained from NIC.

NATIONAL SCIENCE FOUNDATION EXHIBIT on "Progress in Information Processing" is available, without charge, for loan to professional and academic groups. The display, which requires 20 linear feet of space, contains five panels depicting the historical development of computers, a plug-in unit of the first electronic digital computer and electronic packages illustrating miniaturization of components. Exhibit requests, which will be scheduled in order of receipt, should be sent to the Office of Science Information Service, NSF, Washington 25, D. C.

TWO NAVY BALLOONISTS photographed Venus and studied the planet's atmosphere when they drifted over Nebraska at nearly 80,000 feet in a gondola attached to a plastic balloon. The telescopic system used in the 24-hour flight was designed for the Navy's strato-lab balloon program.

EXECUTIVE RESERVE PROGRAM is training a group of 1200 business and professional men who would be called into Government service to staff a production agency in case of a national emergency. Under the guidance of the Office of Civil and Defense Mobilization and the Department of Commerce, work on the program was begun three years ago.

CONTRACTS: ARMY: Ford Motor Co., Aeronutronics Div., production of Shillelagh program, new light-weight surface-to-surface guided missile system for close-in support of troops, \$8,617,624; Northrop Corp., Radioplane Div., production of 400 RP-76 target drones and a flight services program, \$7,524,407; Varian Associates, research and development of UHF high power klystron amplifier, \$1,584,554.

NAVY: Lockheed Aircraft Corp., Georgia Div., production of GV-1 tanker-transport aircraft, \$19,200,000; Westinghouse Electric Corp., initial work on launching systems equipping four nuclear-powered submarines to fire the ballistic missile Polaris, \$5,250,000; Stromberg-Carlson, division of General Dynamics Corp., design and development of a completely transistorized single sideband system, \$1,200,000.

AIR FORCE: General Electric Co., Missile and Space Vehicle Dept., continued development of advanced re-entry vehicles for ballistic missiles, \$101,000,000; Burroughs Corp., Airborne Long Range Input contract, (ALRI is a radar station housed in an RC-121 D reconnaissance aircraft to provide a seaward extension of SAGE system), about \$35,000,000 in the early stages of the 42-month contract; Sperry Rand Corp., development of components for radar set AN/APN-59, \$2,210,594; Collins Radio Co., engineering, manufacture and installation of a microwave communication system for Fairchild Air Force Base, Wash., \$2,000,000.

#### —INDUSTRY—

INTERNATIONAL TELEPHONE AND TELEGRAPH CORP. has developed a new device that can produce high-voltage electricity directly from the warming power of a sunbeam or other heat source. Called a ferroelectric converter, the device relies on the inexhaustible supply of solar heat. Unlike solar batteries which supply only direct current at low voltages and depend on light for their usefulness, the ITT converter supplies both AC and DC current at high voltages and may use other heat sources, such as nuclear heat. The device was announced at the 14th Annual Meeting and Astronautical Exposition of the American Rocket Society.

CORNING GLASS WORKS has formed a new manufacturing department for production of ceramic parts for the electronics industry. The new department will produce ceramic and sintered glass parts for products such as power, microwave and transmitting tubes and other electronic devices, as well as for industrial applications.

GENERAL PRECISION, INC. is the name of the new company formed through the consolidation of four principal subsidiaries of General Precision Equipment Corp. The four firms involved in the move to consolidate management of General Precision's electronics business are General Precision Laboratory, Inc., Kearfott Co., Inc., Librascope, Inc., and Link Aviation, Inc. "As a group, they are one of the most diversified defense manufacturers, with equipment aboard every major aircraft and missile in service or in development," according to General Precision.

UNDERWATER SYSTEMS, INC. is the name of a new firm which will study underwater phenomena with applications for antisubmarine warfare and basic oceanography. Located in Wheaton, Md., the company will specialize in the development of instruments for recording any type of underwater phenomena, including acoustic, magnetic, gamma-ray or other kinds of measurable fields.

MELPAR, INC. received a Letter of Commendation from the Department of Navy for its contribution to the development of a new multi-channel communications facility under the Navy's "500" program. Also commended were the Bureau of Ships, Naval Research Laboratory and the Office of Naval Operations who worked with Melpar on the communications facility.

LOCKHEED AIRCRAFT CORP., GEORGIA DIV. is conducting various weather studies. Lockheed's meteorologists can predict the atmospheric variables affecting the trajectory of a missile at 80,000 foot altitudes. Other projects include low-level wind circulation studies and analyses of air routes and missions.

GENERAL ELECTRIC CO., AEROSCIENCES LAB has developed a device which generates electricity by passing hot gases through a cold magnetic field. Possible uses for the 600-pound device include generating power for televising pictures from a space satellite back to earth and supplying other power needs for the satellite. In the device an electric arc heats the gases up to about 5,000 degrees, while a pair of powerful magnets converts the energy into electricity and a heat-resistant quartz tube carries the current out.

(Continued on page 35)

ANY ENGINEERING activity must be evaluated and considered in the framework of man's entry into the space age. The satellites at present orbiting the earth and other planets are dramatic evidence of the fact that there appear to be few limits to what engineering can accomplish in pushing back the frontiers of man's knowledge. It is significant too, I think, that these accomplishments are international in scope and by no means confined to this country. Russia has so far led us at least in the more spectacular aspects of the space race, but Mr. Khrushchev was kind enough to admit that we would undoubtedly join them before long and plant the Stars and Stripes along side the Hammer and Sickle on the unexplored surface of the moon.

The space age has captured the imagination of everybody and particularly the youth of this country. I have a godson, now a cadet in the Air Force Academy. Recently when I was attending a meeting of the Board of Visitors at the Academy he asked me if I had noticed the age of the men who had been picked for training as astronauts—men in their middle thirties. He said, "About ten years from now we will be able to send a man to the moon and I'm going to be just the right age for it. I may not be the first but I'll be one of them." He said it quite casually but with complete conviction and he may well do it, and he will certainly get no competition from me for the job.

If anyone had any doubts about whether the Society of Motion Picture and Television Engineers (SMPTE) was fully aware of the implications of the space age they have only to take a look at the list of papers presented at their recent convention. (Editor's Note: 86th Semi-Annual Convention of the Society of Motion Picture and Television Engineers was held October 5-9, 1959, in New York City.) Just the titles were enough to frighten a layman like myself—"Image Sensors and Space Environment," "Orbit Determination from Optical Tracking," "Television and Lunar Exploration." What a business for engineers whom we used to consider primarily interested in the entertainment field. I can only hope the gentlemen of SMPTE do not get so preoccupied with space technology that they forget we need a few mundane things like better projection in motion picture theatres and improved kinescope recordings. Do not get too carried away just because our friend Keith Glennan of the NASA got his early training on the Paramount

back lot. (Editor's Note: Dr. T. Keith Glennan is Administrator of the National Aeronautics and Space Administration.) He has problems, too.

One question which we in the entertainment business can certainly ask ourselves is whether engineering in these fields has kept pace with the spectacular achievements in the beginnings of the conquest of space. Certainly the members of SMPTE have had a host of important and significant achievements to their credit since the days of 1916 when Francis Jenkins and a small group of engineers first met in New York to consider the problems of a then young motion picture industry. Foremost of these achievements undoubtedly is the development of the television industry, then entirely unknown and now recognized by SMPTE and the entertainment world as at least on a par with the motion picture industry. This may be a conservative estimate. Color pictures in both fields, stereophonic sound and wide screen processes are only a few of the many outstanding developments for which our engineers are primarily responsible. And yet I somehow feel that in terms of its application to the entertainment field our engineering achievements have perhaps lacked the imagination that has characterized man's advance in space. We have not had a breakthrough comparable to a Sputnik or a moon shot that has lifted entertainment to new high levels aside from and since the advent of television. We have had many improvements, but nothing that has really given a startling new look to the art of entertainment. In saying this I confess I do not have in mind exactly what our engineers might have accomplished which they have not done. Perhaps one simple example might be the development of three-dimensional pictures in color—needless to say, without the use of glasses—but there must be many others.

I might hastily add, however, if we have had any shortcomings in this respect it is not primarily the fault of the engineers. Nor, I think, is it quite fair to lay it to the fact that the bosses, the leaders in the field, are not as sympathetic to the engineer and his problems as they might be. I have heard this opinion voiced more often in motion picture circles than among television engineers but it comes from both and there is some truth in it. This is basically, I am sure, because entertainment is not in any sense an exact science and never will be. It will always depend primarily on creative talent and we can-

## ENGINEERING in the SPACE AGE



Maj. Gen. Edward P. Curtis,  
USAF (Ret.)  
Vice President  
Eastman Kodak Co.

not blame the responsible producer if he many times seems more preoccupied with story properties and stars than he is with improved sound quality or getting more speed and better definition in film. True, the best attraction in any medium can be all but ruined by poor projection, inferior color or bad television reception, but the finest technical achievements cannot make good entertainment out of poor material. I would not necessarily imply that money is the ultimate criterion in judging performance but the relation between star salaries and those of the engineers is certainly more startling in our business than in any other industry. Maybe the moral of this is that we should all have become actors, but at least engineers last longer.

Earlier I mentioned that our achievements in space were international in scope and not confined to this country. The motion picture industry particularly has always been a world-wide business, and television is rapidly becoming more so. More than any other American industry, the motion picture business derives a great proportion of its income from abroad and, for better or worse, probably has great impact on our relations with other peoples or certainly on their ideas of how we live in the United States. Much of this is good and some of it isn't, but I don't propose to assess this in terms of our foreign relations. Mr. Khrushchev and our friend Spyros Skouras have recently had some discussions about this, as you know. (Editor's Note: Mr. Skouras is President of Twentieth Century-Fox Film Corp.)

Although I missed the Hollywood meeting I did visit Russia last August, in common with thousands of other Americans. In fact you saw more Americans in Moscow than you did in Paris or London. The purpose of my visit was to see our U. S. exhibit and not to study the motion picture and television industries. However, I did learn a little about them. First, you might be interested in my impressions of the exhibition because there has been a good deal of conflicting evidence about it. It was designed primarily to show the Russians something about how we live and act in the United States and this it did pretty well. Official Russian circles panned the show, saying that we showed no scientific achievements, no Sputniks or heavy industry but, of course, this was never intended. We did show a typical low priced home and a genuinely average type apartment, besides fashion shows and a beauty parlor which certainly at-

tracted tremendous attention, and I would say, on the whole, a favorable reaction. International Business Machine Corporation's RAMAC (Random Access Method of Accounting Control) was busy answering questions about the price of American cigarettes and explaining Rock 'n' Roll music which the customers obviously were much more interested in than the relative merits of communism and capitalism.

For genuine interest, however, pictures and the printed word stole the show. The library with everything from scientific publications to mystery stories and popular magazines was always crowded and, surprisingly, large numbers of the people read at least some English. One of the real problems was the number of books and periodicals which disappeared—to the great annoyance of the Soviet authorities. There was a rack of newspapers showing dozens of home town papers from all over the United States which obviously showed the enormous contrast between the amount of information available to our citizens compared to the two government controlled dailies—*Pravda* and *Izvestia*, which are all the Soviet people see. The only exception to the American papers I noted was a copy of the *London Daily Worker*.

Parenthetically, I would like to state that hotels in Russia are a phenomenon in themselves. Along with the rest of the tourists I stayed at the Ukraina, a new hostelry about the size of the Waldorf. The rooms were comfortable and there was plenty of hot water but service in our sense of the word did not exist. There was no room service, no concierge and no telephone operator. In fact, for reasons I was never able to discover, there is no telephone directory in Moscow. Either you know the number you want to call or you take a taxi if you want to communicate with somebody else. I came to the conclusion, finally, that a nation capable of producing a Sputnik must run hotels the way they do only because they do not consider this a very important problem in their scheme of things.

Two of the outstanding attractions at our exhibit were the Circarama Show and the projection of still color pictures. The Circarama Show, the 360° motion picture which was shown at Brussels but which has some added sequences of Washington scenes, is a thrilling presentation of the United States. The prints were too dark but I doubt if this bothered the customers very much. Supplementing the motion picture was a periodic projection

in a large hall on seven big screens of still color pictures showing typical American scenes of cities, people, farms, factories and churches. The selection of pictures was good although I personally felt the speed with which they changed made it a little confusing. How much the Russians believed, I do not know but at least several million Russians saw something of our way of life which they could not have gotten any other way. I am sure the net result was good.

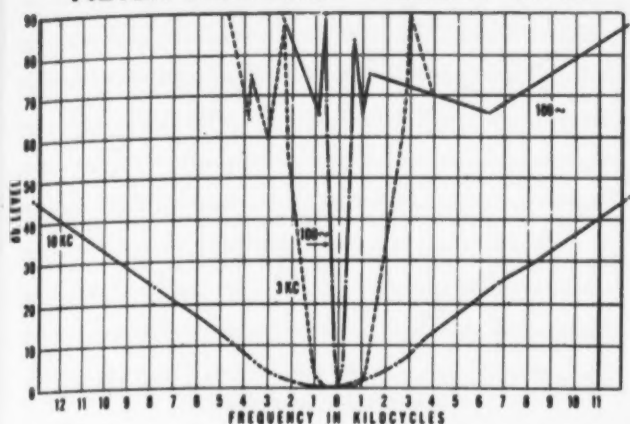
It is not surprising that the picture presentations attracted so much attention because the motion picture is still the outstanding means of communication in Russia for entertainment, propaganda and education. Although television is becoming an increasingly popular entertainment medium the film industry is continuing to expand. There are 77,000 cinemas in Russia today of which about 25,000 use 16mm film and their Seven Year Plan on which the industry is now working calls for the total number to reach 120,000 by 1965. The setup is a raw stock manufacturer's dream because the average number of prints of a feature is about 1000, and many releases run far more than that. Unfortunately, for the Western manufacturers this is all supplied from factories within the Iron Curtain although they have recently purchased a small amount of Eastman color positive and negative, largely for comparison purposes.

The whole industry is basically responsible to the Ministry of Culture although each of the 15 republics of the U.S.S.R. has its own studio and processing laboratory. These vary in size and importance, the major production centers being in Kiev and Moscow. For national distribution the film has to be dubbed into several different languages. The Russian engineers are very interested in 70 mm film and, based on some test films they have made in 70mm Sovcolor, they are convinced it has a great future. Can you imagine what a thousand 70mm prints per feature would mean to the struggling capitalistic raw stock manufacturers? If you do not care whether or not your picture makes a profit it makes a lot of difference.

I was never able to see any TV shows in the short time I was in Moscow. They do not have TV sets in public places and you just do not get invited to a Russian home on short acquaintance. There are, however, over a hundred transmitting stations in the U.S.S.R. and although

(Continued on page 42, col. 2)

FILTER RESPONSE — MODEL 2174A



# RYCOM

## INSTRUMENTS

FREQUENCY SELECTIVE VOLTMETER

WAVE ANALYZER

DIRECT READING IN dbm FOR 135-600 ohm OR BRIDGING CIRCUITS



MODEL 2174A

### SPECIFICATIONS

MODEL	FREQUENCY RANGE	SELECTIVITY	LEVEL FULL SCALE	ACCURACY	TYPICAL FILTER SELECTIVITY
2171A	50 Cycles to 6 Kilocycles	30 Cycle or 50 Cycle Filter	-68 to +32dbm	$\pm .5\text{db}$ -80 to +32dbm 300 Cycles to 4 Kilocycles	<b>30 CYCLE FILTER</b> 6db- 35 Cycles 60db-250 Cycles
2174A	300 Cycles to 400 Kilocycles	50 Cycle or 100 Cycle Filter *	-68 to +32dbm	$\pm .5\text{db}$ -80 to +32 dbm. 300 to 400 Kilocycles	<b>50 CYCLE FILTER</b> 6db- 60 Cycles 60db-450 Cycles <b>100 CYCLE FILTER</b> 6db-140 Cycles 60db-900 Cycles

SPURIOUS RESPONSE: Below 60db

LOW INTERMODULATION: Below 60db

POWER REQUIREMENTS: 115 V. A.C.—50/60 Cycles. WEIGHT: 28 lbs.

\* Including a wider filter and demodulator for monitoring SSB, AM and FM signals.

Submit your requirements for special deviations from above instruments

A highly selective measuring instrument, utilizing the heterodyne principle with balanced modulation, offers fast and accurate means of making amplitude measurements. High resolution is achieved by means of highly selective crystal filters, with a 50 or 100 cycle filter available for amplitude measurements.\*A 3 kilocycle filter with demodulator is provided for monitoring of SSB speech or tone signals.



## RYCOM

### INSTRUMENTS

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9351 East 59th Street Raytown, Missouri

# RYCOM<sup>®</sup>

## INSTRUMENTS

### LARGE SCREEN MULTI-TRACE

## OSCILLOSCOPE

### MODEL RM24

#### 4 TO 24 CHANNELS OF INFORMATION ON A 17" INDICATOR

- UNSURPASSED VISUAL INDICATION
- EXTREMELY VERSATILE
- CALIBRATED TIME BASE
- SAVES MUCH NEEDED TEST SET-UP TIME

THE MODEL RM24 OSCILLOSCOPE can be used in making preliminary test set-ups prior to final data recordings.

Up to 24 channels of complex waveform information displayed simultaneously on a 17" Cathode Ray tube.

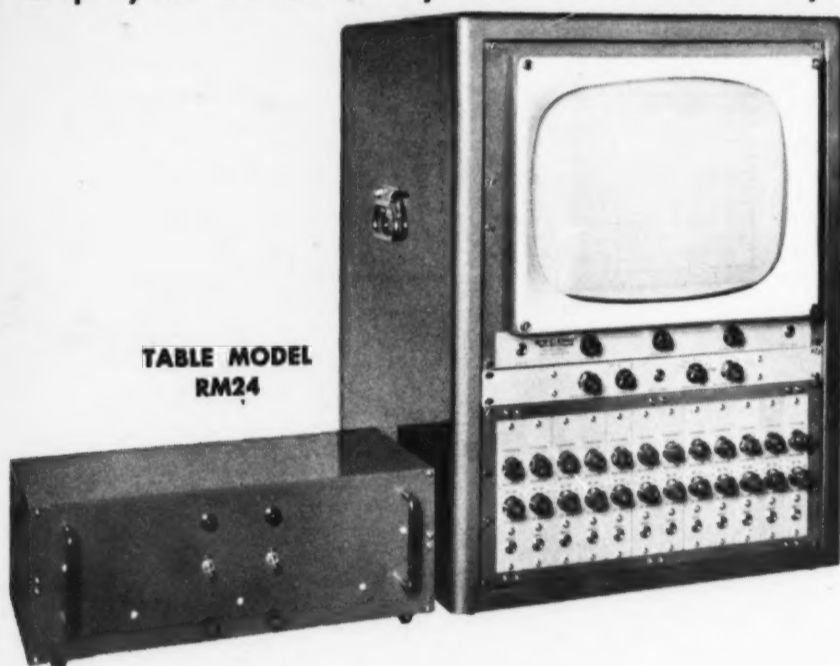
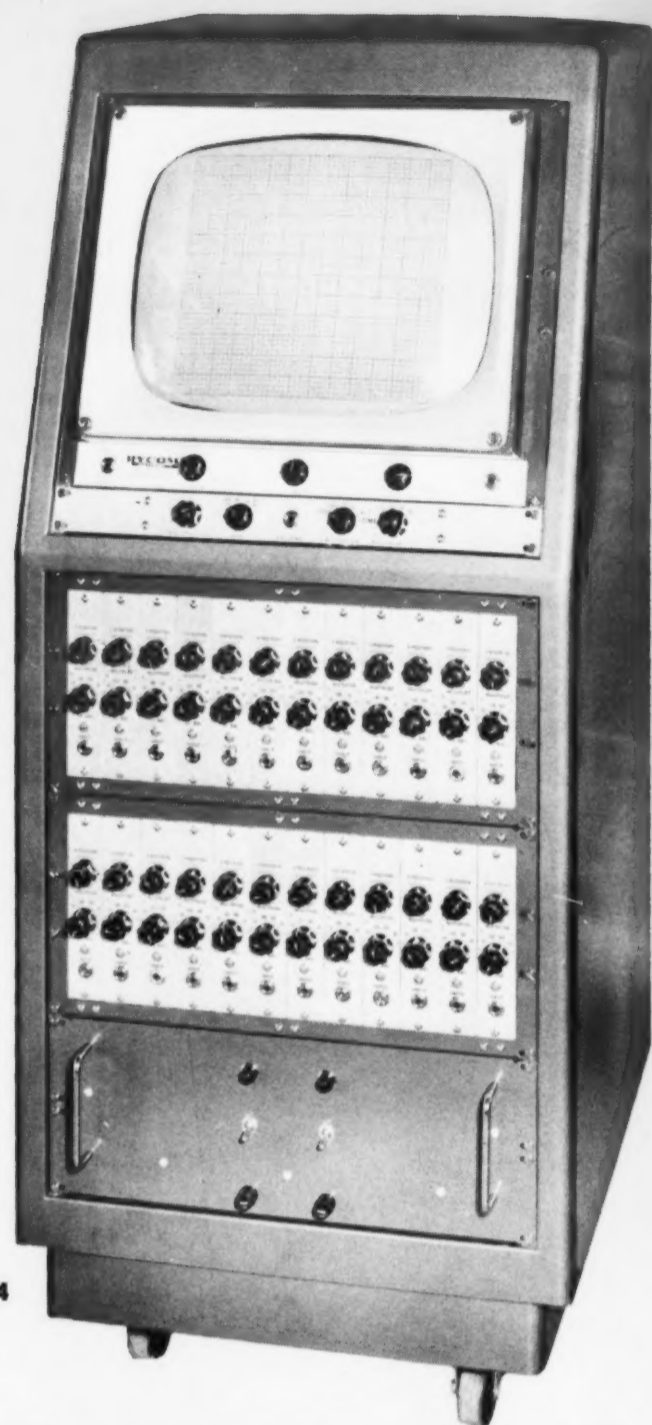


TABLE MODEL  
RM24



CONSOLE  
MODEL RM24

#### APPLICATIONS FOR USE WITH TIME MOTION STUDIES

- VIBRATION, STRESS AND STRAIN
- ANALOG FUNCTION
- STATIC MEASUREMENTS
- BIOLOGICAL WAVEFORMS
- TELEMETERING
- MAGNETIC TAPE-INDICATOR
- DIRECT VISUAL APPLICATIONS

#### SPECIFICATIONS

SENSITIVITY	INPUT	SWEEP	RESPONSE
10 Millivolts Peak to Peak/ inch with Standard Channel Amplifier 2410.	Differential, D. C. Coupled. Input Impedance 2 Megohms—50 Micromicrofarads.	Recurrent or Triggered: Calibrated from 100 Microseconds/Centimeter to 1 Second/Centimeter.	D. C. to 3500 Cycles/Second (10 Dot Resolution for Sine Wave Presentation).

Submit your requirements for special deviations from above instruments

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9351 East 59th Street Raytown, Missouri

#### PARTIAL LIST OF USERS:

U. S. SIGNAL CORPS • BUREAU OF SHIPS • U. S. ARMY ORDINANCE  
BOEING AIRPLANE CO. • NORTH AMERICAN AVIATION • LOCKHEED  
GENERAL MOTORS CORP. • GENERAL ELECTRIC CO. • EPSCO  
GLENN L. MARTIN CO. • BAYLOR UNIVERSITY • COLUMBIA UNIVERSITY

RADIO CORPORATION OF AMERICA has developed a compact radar unit that provides a scanning range up to 18 miles for small crafts. Requiring only three cubic feet of space, the transmitter-receiver unit has four operating ranges from one-half mile to the full 18-mile limit.

GENERAL INSTRUMENT CORP. has developed a new electronic aircraft identification system which can pinpoint and automatically identify any plane in radar range, without voice or other communication with the aircraft's crew. The first completed project of GI's new Advanced Development Laboratory, the identification system was developed under an Air Force contract for the Rome Air Development Center of the Air Research and Development Command, Rome, N. Y. Operated by Radio Receptor Co., a GI subsidiary, the recently dedicated laboratory is working on several other projects, under Air Force and Signal Corps contracts, in military electronic areas.

—GENERAL—

SPACE TRAJECTORY SYMPOSIUM brought together a group of important scientific people in the field of trajectory analysis for a comprehensive survey and exchange of ideas, December 14 and 15 in Orlando, Florida. Sponsored by the Advanced Research Projects Agency, the American Astronautical Society and the Research Division of Radiation, Inc., the symposium featured eight formal presentations, each presentation followed by a discussion period. Some of the speakers included Arthur Shef, Chief, Space Technology Branch, ARPA; Dr. James Ward, Chief, Digital Computer Branch, Air Force Missile Development Center and Krafft Ehrlicke, Director, Centaur-Vega Project, Convair-Astronautics. The presentations, together with edited discussions, will form the basis of a reference volume to be published soon.

EIA MARKETING CONFERENCE explored the question of system selling as opposed to product selling at the Electronic Industries Association's first meeting under its new program, January 5 in New York. Entitled "The Industrial Electronics Market: Marketing Problems in a Changing Field," the conference had the following topics open for discussion: evaluations of new marketing problems, changes in the structure of the industry and the future electronics market—who the customers are and how to find them.

LUNAR LIVING QUARTERS present somewhat of a problem to scientists and engineers, but at the 14th Annual Meeting and Astronautical Exposition of the American Rocket Society it was revealed that inflatable plastic enclosures which provide certain elements are being considered as possible places to live on the moon. Under study are inflatable plastic enclosures which offer the following: an envelope that will contain an atmosphere, volume in which to house man and machine, air conditioning, waste product processing and protection from meteorites and radiation shielding.

NEW RADAR TUBE that will enable the Army's Nike-Zeus anti-missile system now in development "to track oncoming intercontinental ballistic missiles at longer ranges with greater accuracy" has been perfected. One of several types of high-power klystrons developed for the Army by Sperry Gyroscope Co., the new klystron can generate more power per wavelength than any microwave radar tube currently in use, according to the Army.

30 MILLION WORDS A SECOND COMMUNICATIONS may be possible with new electronic devices created by scientists at Sperry Gyroscope Co. These devices include a microwave diode switch capable of switching 700,000,000 bits of information a second and a microwave amplifier tube which can perform logic operations at the rate of 1,000,000,000 times a second. Discussed at the recent meeting of the IRE Professional Group on Electronic Computers, these devices were created for the purpose of developing computers and communications systems capable of handling large amounts of information at speeds at least 1,000 times faster than large electronic computers currently in use.

ATLAS AIRLIFTED FIRST TIME by a Douglas C-133 aircraft in a successful flight that demonstrated delivery capabilities of airlifting the ICBM and carried out logistic studies in connection with ballistic missiles. Previously transported by special truck-trailers, the missile was delivered from Miramar Air Station, San Diego, Calif., to personnel of the Ballistic Missile Division of the Air Research and Development Command at Francis E. Warren Air Force Base, Wyoming.

CALENDAR OF EVENTS:

JANUARY 11-13: Sixth National Symposium on Reliability and Quality Control in Electronics, Washington, D. C.

JANUARY 18-21: Sixth Annual Meeting of American Astronautical Society, New York.

JANUARY 25-27: Eleventh Plant Maintenance and Engineering Conference, Philadelphia.

FEBRUARY 1-4: First Instrument Society of America Instrument-Automation Conference and Exhibit, Houston.

FEBRUARY 3-5: Institute of Radio Engineers Winter Convention on Military Electronics, Los Angeles.

by  
**JOHN J. EGLI**  
 Director  
 Electromagnetic  
 Environment Div.,  
 Engineering  
 Sciences Dept.,  
 Hdqs., U.S. Army  
 Signal Research  
 and Development  
 Laboratory

# **SPECTRUM UTILIZATION IN A FIELD ARMY**

EVERYONE CONNECTED with radio interference reduction is interested in efficient spectrum utilization. Some are interested in its over-all aspects; others as it concerns particular systems; others as it effects design. Whatever the area of interest, our larger job is that of a good salesman—selling our product to the user, the design engineer, the system engineer and the operational user. However, even after selling the product, there is the follow-up of how well the product is being put to use. Does the buyer know how to use it?

The problem of efficient spectrum utilization was well expressed by Major General Pachynski, USAF, in an article entitled "What Price Frequencies?" (SIGNAL, January 1957). He very lucidly pointed out "... the solution (to the problem of spectrum space) lies in the establishment of long term objectives rooted in technological prog-

ress and which, among other things, must take equipment obsolescence into account. The successful achievement of those long term goals is dependent on a joint awareness by all of us of the problem that exists today." Again, in the area of the systems approach to spectrum utilization, Major General Earle Cook, now Deputy Chief Signal Officer, pointed out in "Efficient Spectrum Utilization" (SIGNAL, November 1957) that one approach to understanding our usage of the spectrum and its crowding is through a very detailed analysis of the electromagnetic environment. This detailed type of analysis has been applied to the field army, and the method is certainly applicable to all Electromagnetic Environment density engineering.

There is a great tendency to engineer after the fact, that is—to wait and see what will happen after an item hits the field. Actually we should be concentrating our engineering before the fact by including in our systems engineering of a complex environment, the technical characteristics of a black box when development is about to begin. In other words, we should understand the realm in which the black box, still to be designed, will live when concentrated with other types of black boxes in a shelter or vehicle, in density on a hill top or scattered in abundance in a field army area.

Consider as standard procedure a method for efficient spectrum utilization which has been applied against the field army and which can be briefly described as follows:

- a. Conduct a survey and estimate of systems requirements of the field army organizations for
  1. Air navigation and traffic control
  2. Combat surveillance
  3. Communications
  4. Radar—IFF and missiles
  5. Other radiating devices
- b. Reflect all these systems and its associated equipments on a geographical deployment.
- c. Use the best known frequency assignment methods, which must include a thorough knowledge of wave propagation as it limits individual systems, and the spectrum emission of equipments.

I have stressed here the best known method of frequency assignment because in reality so little is known of good frequency assignment management which will permit adding to the connectivity of given systems and which will provide for full mobility. Don't underestimate good frequency assignment methods as a means of exploiting efficient spectrum utilization and reducing interference.

This method of analysis, as many of you recognize, is one which Project MONMOUTH uses in its Field Army Communication—Electronic Mutual Interference studies. In order to evaluate the compatibility of equipments to interference, all of the information above

can serve as input to a computer. The computer calculates for each receiver the level of the desired signal and then each receiver asks the computer if there are undesired transmissions co-channel, adjacent channel, heterodyne ( $\frac{1}{2}$  IF and 2 IF) and harmonic which will exceed the desired level and what is the probability of such interference. The output of the computer can then be analyzed and presented as the degree of interference suffered by all systems. It will show where improvements or changes must be made, for example, in increased frequency spectrum usage, in emission characteristics, allocation requirement, and so forth.

The degree of reliability which can be placed on such studies depends largely on the sophistication of the inputs to the study. For example, how well understood are the emission characteristics of the equipment, the laws of wave propagation over irregular terrain, the interference potential of AM to FM, FM to Pulse, Frequency Assignment techniques and other analysis parameters which require more understanding than presently available. However, very fortunately, concentration on known needs for improvement is generally reflected in an increase in know-how and here we feel that great strides have taken place, even though we still have a lot of ground to cover.

In this whole area of understanding the Electromagnetic Environment, the U.S. Army Signal R&D Laboratory has strengthened its position considerably by the recent formation of an Electromagnetic Environment Division by Col. H. McD. Brown, Commanding Officer of the U. S. Army Signal Research and Development Laboratory. This Division will have four branches under its wing, one of which is Project MONMOUTH. The others are Interference Analysis and Control Branch, concerned with exploiting good emission characteristics, Vulnerability Branch, concerned with susceptibility of receivers and AJ techniques, and the Suppression Branch with broadband and narrowband suppression and testing.

Along the lines described above, you will find the members of this Division in on the QMR'S, MC'S, the technical requirements, contractor proposals, and the testing for conformance with the specification of the experimental, engineering and service test models.

My purpose in this brief explanation was to indicate a way to convince people of the need for efficient spectrum utilization. I feel that the signal complex for the future field army, and it should be applicable to all communication-electronic devices on a worldwide basis, will not suffer intolerable mutual interference if thorough systems planning and engineering is conducted by making full use of good equipment design criteria, optimizing methods of spectrum allocation and using realistic techniques of frequency assignment.

# FUNCTIONS OF A WASHINGTON OFFICE IN SECURING GOVERNMENT BUSINESS

by HARRY A. CARRAGHER  
Manager,  
Defense Products  
Marketing Service,  
Inc.

*Editor's Note: Mr. Carragher has been associated with engineering, procurement and contracting for many years. In the following article he speaks on a subject with which he is especially qualified. He has made the study of the interrelationship of Government and industry business the major concern of his Washington office. The purpose of his article is two-fold: first, to familiarize industry with the necessity of doing business with a reputable and established civilian organization in Washington; to insure proper company representation for Government business through ethical practices and within the prescribed laws; second, to acquaint industrial management with the vast amount of work and responsibility which the position of "Washington Representative" entails. It is Mr. Carragher's conviction that only a well qualified and properly accredited civilian office can effectively represent those industries interested in Government business.*

WASHINGTON IS THE nerve center of a vast network of listening posts. Information is pumped toward Washington in tremendous volume. When Washington speaks, the world listens. Before it speaks, Washington listens.

Knowing where to secure essential accurate facts and where to present your descriptive data is the key to your success.

Most Washington procurement and supply activities are concerned with persuading buyers and engineers to take a position favorable to your product and anticipating requirements in the design stage. Production measures can thereby be planned in advance. Pre-planned, intelligent effort directed to the proper people will be productive of orders and result in a profitable, reliable, Washington operation.

To achieve objectives, the Washington branch combines informational skills and research and schooled experience in anticipating developments. There is no substitute for personal contact and experience. Basic to all else is a thorough knowledge of the Federal Government.

For maximum success in Washington, procurement and engineering activities and specialized judgment factors must be added to those exercised in the home office in order to be of professional and economic significance.

In interpreting "requirements" it requires more than "knowing your way around Washington." Experienced judgment in analysis and interpretation must be added. Ex-

planation of the significance of complicated procurements, specifications and spare parts provisioning is basic to shaping the outcome of "Inquiries for Quotation."

Critical timing can make or break a Washington branch office endeavor. For instance: when to make a prior evaluation, when to hold a special meeting, how to obtain advance information, how to make a competitive quote, ways of avoiding competition by knowing cost of production and potential. (An obvious example of the latter is in researching previous awards and maintenance problems).

In processing competitive quotes, hand-in-hand timing goes with analysis of competitive bids to determine if they are in accordance with government specifications.

Fundamental to all techniques are good working relationships with officials and the project engineers. These can only be based on mutual confidence and respect.

For organizations without Washington facilities, a local office can assist in forming policy and executing plans aimed at affecting or even creating prospects.

## Resolving Problems

Operating in the broad Washington framework, the Washington Office undertakes highly varied assignments.

Government product surveys can lead to nation-wide results. Surveys often are the best starting points for manufacturing programs. An initial survey can make a national program

more economical in that it minimizes false starts and costly but non-productive activities. Nothing else offers such a reasonable base line for gauging results.

Objective and directed research can bring results. Surveys and analyses of government requirements can ascertain the facts necessary for Washington results. Directed research in non-technical and non-scientific areas is a basic step in formulating New Product Development Programs. Many Washington programs fail through lack of facts. Whether or not research is intended to foster New Product Development, two matters are fundamental: (1) selection of the essential facts, and (2) absolute accuracy.

Specific tools and skills are employed in operating "Intelligence Programs." A Washington Office, like one elsewhere, may employ scores of different techniques. Here are some which have produced results: producing informational assistance to the government with specially designed company brochures communicating the company's message to the right audience, in the right way, and at the right time; keeping reference libraries current with company product catalogues; arranging special events to create goodwill in a group or to make contacts more efficiently.

## Techniques Peculiar to Washington

Long experience proves the following factors are necessary in Wash-

ington: experienced advice on new applications, where and when the products are used; quick and professional forwarding of facility information; knowing requirements and where they are initiated; speedy physical delivery of quotations; reaching out-of-town contracting officers with specific Washington information, and supplying personalized explanations of complex engineering problems.

Another factor to be considered is the fast, accurate reporting of matters such as timing, reference to company's product trends, adversaries' position and tactics. Emphasis is placed on items of interest to the company, such as procurement awards, which are covered incompletely, or not at all.

This reporting also covers the following: systematic canvassing of pertinent Executive agencies, particularly prior to procurement, and during the planning stage; "Administrative Memoranda," suggesting actions the company might usefully take, and cross checks on all information in order to ascertain technical features or special implications.

This fast interpretive reporting brings home to the company its specialized problems, how its interests are being affected and what it can do about them.

### Coordination

The purpose of a Washington Office is to assist and coordinate with all divisions and departments, in accordance with sales and engineering policies, in expanding defense business.

To find new business and service the business already on hand are the primary functions. Also, the Washington Office develops a better understanding of the needs of the Armed Forces.

The following points illustrate how these functions are carried out:

- 1—Select military products suitable for manufacture by company and division. Determine fields of interest for research and development business. R & D today is production of tomorrow.
- 2—Establish company on source lists, for all products, and at all points within the Federal Government, military and civilian agencies. Personally describe the company's capabilities and facilities to the hundreds of project engineers and officials.
- 3—By means of listing of some 4,000 classes of commodities, the Directory covers the more

than 5,000,000 individual items purchased by the military and civilian agencies of the U. S. Government.

- 4—Arrange for government personnel visits to factory. This is a two-way street.
- 5—Assist company representatives in handling prime contractors who are doing business with the government. This applies to contractor or government furnished equipment on government purchased vehicles; i.e., new applications, revised specifications, drawings, quality control problems, and initial spares provisioning.
- 6—Co-ordinate various factory departments on "How To Do Business with The Government"; i.e., procedures, regulations, technical data, contracts, etc.
- 7—Make advance appointments with the right people for company personnel to visit government installations, securing personnel security clearances.
- 8—Secure current information on competitive equipment.
- 9—Keep abreast of new developments for new business.
- 10—Maintain liaison with research project engineers.
- 11—Scan all procurements, and procure bid forms, specifications, test data, and drawings if not already forwarded to company.
- 12—Delve into previous purchase history of item to guide company in bidding and negotiating contracts. Advise company on bid procedures and changing government regulations.
- 13—Follow up bids and proposals, and advise company as to status and successful bidder information. Tabulate large orders.
- 14—Learn sources for purchased items of all company products, country-wide, in all divisions and development.
- 15—Advise company, and assist in any contract negotiations, both for production and research and development.
- 16—Advise company regarding accounting procedures in segregating costs for price redetermination and negotiation.
- 17—After contract is obtained, maintain liaison with buyer and project engineer regarding any subsequent changes, production problems, inspection problems, maintenance and spares provisioning.
- 18—Follow up qualification test samples in engineering laboratories, and handle certified test reports,

19—Expedite payment of invoices by finance officer.

20—Keep tab on large prime contracts awarded regarding possibilities of obtaining a subcontract, especially on new projects in the design and planning stages.

21—Keep corporate name and products fresh in buyer's and engineer's minds, to avoid being overlooked on any procurement.

22—Carry to higher authority an appeal on any arbitrary decision made at lower levels which seems unjust or prejudicial to company's interests and the "best interests of the Government."

23—Furnish company sales and engineering literature for reference libraries, procurement, engineering and test laboratories.

24—Secure advance planning and requirements information for sales, production and planning.

To be successful in handling government business, it is important to maintain an effective "intelligence" system twenty-four hours a day. You cannot afford to be less informed than your competitor.

Some of the work is difficult to appreciate insofar as indirect sales are concerned. However, the proper efforts directed to the right people are productive of orders both directly and indirectly (i.e., selling today for orders tomorrow).

The suppliers who maintain local offices usually have an advantage since a government buyer or engineer can discuss and secure critical information and assistance verbally on an informal basis. This action precludes the delayed difficulty by government personnel in making long distance telephone calls and writing official letters. Through personal contact, it is more practical to preview engineering changes and deviations with the respective engineers prior to making formal application.

You are aware that the above applies to all headquarters military services and government establishments in Washington, D. C., Air Materiel Command, Wright Air Development Center at Dayton, Ohio, Air Research and Development Command at Andrews Air Force Base, Aviation Supply Office in Philadelphia and Army Ordnance in Detroit; it is also necessary for frequent contact with the prime Air Materiel areas, Navy establishments, and Department of the Army wherein our products are purchased, overhauled, and provisioned for spares, from coast to coast.

A salesman can be of immense assistance to engineers by his knowl-

edge of sources, procedures and contracts. In this area of greater technicality, complexity and revolutionary change, no industry is more affected than aviation. The U.S. Air Force is the biggest single market in the world today.

In the guided missile program, the contractor responsible for the development makes his selection for sources of supply during the development and design stage. The prime contractor decides at this point on sub-contractors for initial supplies required for ground and flight test.

Military Air Services continue to be the largest purchasers of aviation equipment, material and services. Aviation manufacturers who want to get their share of this lucrative market should contact the key technicians considered most important in product specification and purchase.

There are in the U.S. Armed Forces as of December 1958, 4,000 Headquarters and Command engineering scientific personnel and 7,000 military officers and civilians responsible for procurement and supply. This includes key personnel in the Army, Navy, Air Force, Marines, Coast Guard and the Office of Secretary of Defense.

In other civilian U.S. Government agencies, there are about 100 engineers and 300 procurement personnel.

In addition, this program is applicable to all procurement and engineering divisions throughout the country wherein decentralization has occurred, in accordance with the respective products in which we, or our divisions, are interested. In the metropolitan Washington, D. C. area this pattern of contact is amplified many times over, plus visiting the foreign purchasing missions for export business through the Department of State. Also, it is well to maintain effective liaison with our prime customers' government division offices, in headquarters cities like Dayton, Washington, New York, Chicago, Philadelphia, Los Angeles and San Francisco.

As you know, government business is not a fringe business, and therefore, it is necessary to be conversant and kept abreast of the day-to-day changes that occur concerning all of our products and fields of interest. In this connection, it is advisable to attend various government and industrial conferences as well as arrange for company exhibits, hotel accommodations and transportation.

The foregoing is furnished for your information and consideration concerning our over-all program.

### "Rayescent" Lamps

(Continued from page 23)

ized or vacuum deposited on the plastic layer. This becomes the second electrode. A suitable protective coating is applied to the entire back so as to insulate the entire lamp. Lamps of this type are known as glass plastic and generally produce higher brightness than ceramic lamps. All connections on this lamp can be made from the back, thereby leaving the front surface completely free from any connections and insulated by the glass itself. Lamps of this type are now for sale under the trade name of "RAYESCENT" Lamps.

Experimentally, lamps of the sandwich type have been made on plastic, cloth and wire mesh. Many of these are or can be made flexible. Much work is being done to improve the maintenance of lamps built on the back side of plastic panels. Early results indicate that this type of lamp will soon be ready for adaptation to aviation panel illumination. Obviously, considerably more data are needed before life, color, and brightness can be accurately predicted. One of the major problems is getting an acceptable red at 400 cycles and voltages available on most aircraft. Reds have been produced directly but these require higher voltages and frequencies than are generally available. For the present, the best reds, at lower frequencies, are obtained by filters or by a cascade process utilizing a photoluminescent organic dye.

Multi-layer lamps have been made in the laboratory. Each layer is connected through a series inductor to a common variable frequency power supply. Since the layers are capacitors, a set of tuned circuits is thus formed; by proper selection of inductors only one layer at a time is excited as the applied frequency is varied. The layers, being transparent, allow the lighted layer to be seen by transmission through layers over it. Multi-layers could, by proper connection and switching, be lighted, selectively or collectively, from a common source of power or fixed frequency.

Work in the glass plastic type of lamp has shown that this type could well become a light source of the future. Recent work has shown that a fair white can be produced at 60 cycle operation. Other colors too can be operated at these low frequencies. The data accumulated thus far indicates that maintenance of brightness seems better at 60-400 cycle than at higher frequencies. Present efficiencies of 60 cycle green are in excess of 12 lumens per watt, with other colors

falling somewhat below this figure. However, work now in progress indicates that, if present rates of improvement continue, efficiencies of 20 to 25 lumens per watt will soon be realized.

Lamps can be made in many shapes and sizes but in general, flat planes are the easiest to handle. Dials can be fabricated with legends silk screened on either the front or back surface of the glass. Holes can be cut in the glass before it is fabricated into a lamp and the back conductor can be made into several segments so that a display may be presented. This feature offers the possibility of presenting digits and alphabet or symbolic data.

Several designs are now in the engineering stage for either numerical readout or alphanumeric readout lamps. One such design can show any digit from 0 thru 9 with only 9 segments. Engineering samples are being made in two sizes,  $1\frac{3}{8}$ " high digit and  $2\frac{3}{4}$ " high digit. These will offer designers of computers and readout systems an opportunity to display information with practically no loss of detail and visibility even at wide viewing angles and, in many cases, offer considerable savings in power consumption. These devices could open up a new approach in the advertising business for data or information presentations.

There are many areas where data still needs clarification. Some of the mechanics involved in producing light are still not agreed upon but enough progress has been made to predict that this new and exciting source of light may soon become another tool in the hands of designers and engineers that will perform lighting services that even today are not yet possible or are at best, only a compromise of the results desired with the means available.

Progress has been made in converting electricity directly into light with RAYESCENT Lamps, but the real progress has yet to come—that of making this potential a reality—by increasing efficiency—by lighting whole rooms or buildings—by applying the lamps to signs and displays—by being able to select the color, intensity and mood desired from a flat plate—by supplying good diffuse illumination in places where today it is not possible or economically feasible or by supplying light in areas in planes, submarines, in fact, in almost any area where space is at a premium and seeing is a prerequisite. To quote from one of the learned gentlemen of the entertainment world, "You ain't seen nothing yet."

# \* MINITAPE



... a fully transistorized, battery-operated, portable tape recorder of network recording quality.

**AMAZING OPERATING EFFICIENCY . . .**  
No other recorder can do the job of Minitape. Where you go, Minitape goes, with its own power and precision recording unit in one compact aluminum case. Minitape weighs only 13 pounds and equals the finest AC-operated units in recording quality.

- Automatic volume control by transistor amplifiers holds constant full recording level from lip distance to 10 ft.
- Flat frequency response to 10,000 cycles at 7½ ips.
- 2 hours continuous recording on one charge. Lifetime nickel cadmium battery.

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**HOFFMAN**

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## CENTAG

(Continued from page 16)

requirement demanded an on-line tape relay capability with mobility and flexibility comparable to the rest of the system. To accomplish this using the type of equipment with which the 17th is equipped was a real challenge. The equipment, the AN/FGQ-1, was designed for fixed-station usage, not tactical; it is bulky, heavy, temperamental, fragile and difficult to maintain. Its fragility could not be overcome so a means of eliminating its awkwardness of maintenance was sought. The solution was found in rack-mounting it. The components were removed from the heavy wooden tables and they were mounted on a specially designed metal rack made of angled aluminum strips in a way which provided maximum exposure for maintenance. (The Army Security Agency approved the method used after certain cable-shielding was added). This technique also overcame much of the problem of bulk by using vertical space in lieu of horizontal. All of the equipment required to terminate a circuit—cryptographic, teletype, monitoring and power—is contained in a single rack. With these racks, eight circuits can be terminated and operated in a single van.

The size of the communications system, its complexity, the requirements for its flexibility and the urgency of the dependence on it resulted in a serious need for the presence of a focal point for controlling, testing, re-routing and restoring circuits and systems. Such a focal point is known

by many names in communications circles—faults control, facilities control, circuit control, communications control and others. A strict definition of each would reveal a degree of distinction but the name is not that important. The 17th chose to call theirs a Facilities Control. Each of the command operations companies has a Facilities Control. One was achieved by an adaptation of the Teletype Switchboard van of the AN/MS-5, the other was built from scratch in a cargo van and has slightly greater versatility (Figure 3). The technical capabilities of these facilities are quite extensive, including the capability to meet all of the requirements mentioned above as well as to measure motor speed and distortion and to match the many diverse teletype signals used in Europe. They have proven the validity of the communications control concept at this tactical level.

These are the most significant accomplishments in the effort to achieve maximum mobility of communications. Together with the component vans of the AN/MS-5 and other build-it-yourself facilities, they enable the battalion to accomplish its communications mission without the sacrifice of mobility which accompanies the usual dismounted posture of large-scale communications systems. And particularly important is the compatibility with the flexibility and versatility of the new organization.

This has been accomplished without destroying the identity of any communications or transportation equipment. Everything can be returned to its original state if necessary so that no question of propriety occurs.

### Summary

These two programs—reorganization and equipment-mounting—have produced highly beneficial results in terms of consistency with the tactical concepts of the headquarters supported. Progress was sometimes slow; objectives were sometimes elusive or obscured by the means; a few false turns were made. But the result is extremely gratifying, meeting the need for a more responsive capability, organizationally and in terms of equipment, a greater capability for meeting the challenge of command control under the conditions of nuclear warfare as compounded by the problem of immediacy attendant to the requirement of readiness in Europe. In its entirety, it is limited as a solution under other conditions. The equipment program can be characterized to some extent as field expediency and reflects local circumstances. Certain aspects would, however, apply equally well under other conditions. The rack-mounting of on-line cryptographic teletype terminations, for example, would be beneficial to any major tactical user of on-line teletype. The VHF Quad van is also applicable to other situations and is highly recommended as is the facilities control concept. Similar adaptability may well apply to other expedients.

The basic principle of the reorganization, itself, is applicable to the long-range problem of communications support in the new army. Flexibility and responsiveness must be achieved if the communications mission is to be accomplished. Decentralization and delegation, properly controlled, will provide these qualities. The organization developed and field-tested by the 17th Signal Battalion, is sound and has been endorsed by all cognizant observers. Highly significant is the response it has generated among the officers and noncommissioned officers who have put it into effect—approval has been almost unanimous.

By means of these two programs, the 17th has increased substantially its capability to place at the disposal of the Commanding General of CENTAG a means of exercising command control under conditions of extreme flexibility and mobility.

### Keep SIGNAL Coming

Please let us know if you change your address so that you can continue to receive SIGNAL without interruption. Notify the Circulation Department, SIGNAL, 1624 Eye St., N.W., Washington, D. C.

*National Headquarters of AFCEA is receiving more and more inquiries from well educated and executive trained personnel over 40 regarding employment. The requests from civil and military personnel for information, contacts and the names of reliable organizations to prepare individual brochures or biographies and possibly to assist these individuals has prompted your editor to obtain the following article. Many individuals and organizations perform a service in the employment field. Forty Plus, 810 Eighteenth Street, N.W., Washington, D. C., was selected for the following story because they are representative of the type of service available and through experience have demonstrated the value of such organizations.*

**F**ORTY PLUS OF WASHINGTON and the eight other Forty Plus Clubs in leading cities are one of the few organizations standing for what should be a leading American principle—the right of a man over forty years of age to employment and to earn a living. Founded in Boston in 1938, during an era when discrimination on the basis of age was prevalent, both in governmental and industrial circles, the organization was, for years, almost totally alone in opposing the erroneous concept of “actuarial death” at age 40. Even today, aside from the Federal and a few state and local governments, Forty Plus is still the leader in the movement to oppose the unrealistic policy which claims that a man becomes unemployable at an arbitrary age. All of you who read this will one day pass the forty-year mark, if, indeed, you have not already done so.

Forty Plus does not have the equally unrealistic concept that a man is acceptable simply *because* he has reached a certain age. There has to be some limitation on the type of members acceptable. Executives forced out of employment by mergers or business failures, retired military or Civil Service personnel, and various types of professional people, found themselves over forty, with a good many years of invaluable experience in getting things done and frequently with the heaviest financial burdens of their careers due to children who had reached the ages of secondary school or college. These men were found to be at the peak of their value to employers, whether private or government, with many years of useful working life ahead of them. Once displaced, however, from an organization in which they might have

spent twenty or more years, they found themselves in what is perhaps the most difficult group from the viewpoint of further employment. In most cases, the reasons they were unemployed were arbitrary. These men were far from through. For this reason, Forty Plus has limited its membership to men in the executive class.

This does not mean that only unemployed corporation presidents may join. The qualifications are simple. A member must be a U. S. citizen, have been employed in a responsible supervisory position in some form of administrative, technical or professional work. He must have earned at least \$5,500 per year and he must give three reliable and easily accessible references. These points are carefully checked by the membership committee, the applicant having usually been interviewed by two mem-

#### SIGNAL Staff Report

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bers, and a vote is taken by the Executive Committee before an applicant is admitted to membership. The membership. The “screening” procedure is an amazingly high average of quality and experience among the ess performed by the membership committee eliminates practically all undesirables and has been considered as a procedure of considerable value to employers, either private or governmental.

Membership now in Forty Plus of Washington, D. C., represents retired government officials, military officers, executives in banking, manufacturing and public relations, teachers, en-

gineers, lawyers and, in fact, representatives from nearly every type of executive or professional work in which the requirements of the Club can be met, except, perhaps the fields of art, medicine and dentistry. Even here, however, they come close, as two current members have had experience in hospital administration.

Members are guided in selecting private employment agencies with which to register (Forty Plus cooperates with all private agencies and charges no placement fees), and in the vitally important job of writing suitable resumes, of which they are required by Club rules to keep an adequate supply in the office for use by the placement committee. Men retiring from the military or other federal service find membership particularly valuable, as it helps them to get oriented and started in seeking employment in new fields. Each serves on one of the committees which do the day-to-day work of the Club—membership, marketing or placement. Each one is made aware of his responsibility in finding work, not only for himself, but also for any other member who may be qualified. No salaries are paid and all work of the Club is done by the members themselves during the two days a week they are required to devote to such activities while they are active members and still unemployed. All expenses are supported by membership fees which are kept as nominal as possible.

Forty Plus members do not sit around waiting for a \$50,000 a year job. Most are satisfied to find useful and congenial work to do at reasonable salaries. Naturally the requirements of the individual members vary according to their circumstances. But Forty Plus is not a “silk stocking” organization. The members are mature, qualified, experienced, want suitable employment and are looking for it and have enough common sense to be reasonable in their salary requirements. A bulletin, listing available members and giving a short account of the background and experience of each one, is sent to several hundred prospective employers regularly, but only if they have requested that it be sent. The placement desk sends resumes of appropriate members to employers who contact the Club and occasionally to organizations where there appears to be a reasonable prospect of employment. All members are urged to accept the possibility of relocation, should a job appear in another locality, and many are willing, even eager, to go overseas. Those who en-

counter job possibilities which they are unable to accept themselves while conducting their own private search for employment, report such jobs to the placement committee for the benefit of others. In the event they have been sent out by an employment agency and cannot meet the requirements of the position or are not interested in it, they report the name of the employment agency to the placement desk so that other members may be referred thereto, thus protecting the private employment agency while getting members in touch with job possibilities.

There is a lot of leg work and desk work connected with membership in Forty Plus but the members find it most rewarding, not only from the viewpoint of obtaining employment but also from the valuable friendships formed and the satisfaction of helping others. The type of man in Forty Plus finds hard work and devotion no strangers.

Altogether they provide convincing validity to the motto of Forty Plus—"There is no substitute for experience."

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## Engineering in the Space Age (Continued from page 32)

no one seemed to know the number of receivers, I have seen the figure of 3,000,000 mentioned in other reports. The sets I saw in the big government department store, Gooms, looked a little junky and quite expensive—2,000 to 3,000 rubles or \$200 to \$300 at the tourist rate of 10 rubles to the dollar. At the big permanent Russian exhibition in Moscow they have quite an impressive electronics building where they were broadcasting experimental closed circuit color TV but unfortunately there was only a test pattern on when I was there. There is no commercial color TV as yet and they seemed to be very indefinite as to when they expected to have it.

The situation of our industry in Russia is interesting, as almost everything in that country is to us at the present time, but there is no potential Russian market in the foreseeable future for the products we make. I would guess that our sales of motion pictures, television sets or programs, raw stock or anything else will be on only a token basis for many years to come. The people responsible for the control of Russia's economy just aren't very interested in supplying consumer goods, even though there has been some relaxation in this respect in the last two or three years. Certainly such consumer goods as may be available will be produced locally and not paid for with foreign exchange.

Fortunately for us, however, the rest of the world is much more receptive to the import of our entertainment products. As we all know, in spite of exchange problems, quota restrictions and government subsidies, the motion picture is still pre-eminent on the screens of the world—at least the world outside the Iron Curtain. Obviously, the entertainment value of our pictures has universal appeal but the technical achievements contributed by our engineers are as important in Tokyo as they are in New York.

Television, on the other hand, really is just beginning to spread its wings on the international scene although amazing progress has been made in the last couple of years by those producer-distributors of programs who have made determined efforts to develop overseas markets. Some companies are now getting as much as 20% of their total gross receipts from abroad and expect to double this within the next five years. So far I do not believe the producers of TV programs have given the same

attention to the possible international appeal of their material as the motion picture producers have long been accustomed to do but apparently this has not been necessary as yet. The same programs which have proved popular in the United States are enjoying the same success in overseas markets.

It is obvious then that the twin interests of motion picture and television engineers are international in scope to a greater extent than those of most other American industries. The results of the achievements which have been made and will be made in the years to come have a tremendous impact not only here at home but before millions of people in other lands. Therefore it places all the more responsibility on motion picture and television engineers for seeing to it that our engineering keeps up with the challenge of the space age and that America's position in the international world of entertainment continues to be one of leadership. Moon shots and manned flights into space have great box office attraction and will continue to until they become commonplace, as they doubtlessly will do one day. Thirty years ago Lindbergh's transatlantic flight was the newspaper story of the year, but today the only transatlantic flight which could make the papers would be one which did not get there. I am not suggesting, however, that motion picture and television engineers should set their goals at competing with rockets and satellites nor can they afford the costly trial and error approach that has perhaps necessarily characterized our efforts in this field. Space engineers have access to the taxpayers' money which we in the entertainment business do not and I hope never will. What I do think we can learn from this fascinating world of astronautics is that there are no limits to the accomplishments of men's minds—no boundaries or obstacles which cannot be overcome if we have the will to do it. Many of these incredible developments have been forced on us by the sheer necessity of survival. To a very considerable extent fear has been the driving force which has pushed us forward and fear is not a good master.

Fortunately, motion picture and television engineers have other motivating reasons—pride in their profession, pride of achievement and, I am sure, a determination to keep this country ahead in their chosen field. I am confident that our engineers will fully measure up to the challenge of the space age.

-----



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The President, the immediate Past President, the Vice Presidents and the Counsel are ex-officio members of the Board of Directors.

\*Executive Committee Member.

## Association affairs



Officers of the new Syracuse chapter discuss plans for the chapter's first meeting. Front row (l to r) Colin W. Getz, Col. Arthur E. Stanat and John G. Labedz. Second row (l to r) Marshall F. Cook, James R. Wescott and John F. Riddler.

### New Chapter

AFCEA's forty-eighth chapter will hold its first meeting January 13th at Syracuse, N. Y.

Officers of the new chapter are Colin W. Getz, Division Traffic Superintendent, New York Telephone Co.—president; Col. Arthur E. Stanat, Communications and Electronics, 26th Air Division—first vice president; James R. Wescott, Jr., Manager, Sales Army Program, General Electric Co.—second vice president; Marshall F. Cook, Central Office Chief, American Telephone and Telegraph Co.—third vice president; John G. Labedz, Production Manager, Western Electric Co.—secretary and John F. Riddler, Manager, Western Union Telegraph Co.—treasurer.

National President Benjamin H. Oliver, Jr., will present the chapter its charter and James M. Bridges, Director, Office of Electronics, Office of Secretary of Defense, Research and Engineering, will be the guest speaker. Also attending the meeting will be Region-A Vice President Glenn D. Montgomery.

National Headquarters extends its congratulations to Mr. Getz and the members of his committee for the active interest they have taken in organizing AFCEA's newest chapter.

### Honorary Member

Capt. R. F. Rea, Chief, Communications Division, U. S. Coast Guard, has accepted the Association's invitation to become an honorary member during his term of office as communications chief.

### Coast Guard Award

The first presentation of the AFCEA award for proficiency in electronics at the Coast Guard Academy will be made next June to a member of the 1960 graduating class.

Since 1948 the Association has been presenting annual awards at the United States Military Academy to the graduating cadet having the highest rating in electrical engineering and at the United States Naval Academy to the graduating midshipman having the highest rating in electronics. Beginning last year, the Association presented a similar award at the Air Force Academy to the graduating cadet standing highest in electrical engineering.

### Special Navy Issue

In the April issue, SIGNAL will present a series of articles prepared by the Navy Department on the Navy's progress in communications and electronics. (See page 13).

Rear Admiral Frank Virden, Director, Naval Communications, has given permission for the special Navy issue which will be the second issue devoted to the work being done by the services. Last March the U. S. Army Signal Research and Development Laboratory at Fort Monmouth, N. J., prepared a series of articles on components for publication in SIGNAL.

### Executive Committee Meeting

AFCEA Executive Committee will meet January 14 at 9:30 a.m. at the Hughes Aircraft Company, 1612 K Street, N.W., Washington, D. C.

**R**EGION C VICE President Kelly Mosley has initiated an appeal and letter contact program for all members in his area who through oversight or other reasons have failed to send in their renewal applications for membership. Mr. Mosley is acting upon the strip list which National Headquarters is making available monthly to all Regional Vice Presidents and Chapter Presidents at the time of sending out our third renewal notices to individual members concerned.

In his letter, Mr. Mosley stated, "As a member of AFCEA I hope that you will continue your affiliation with us. We want and need your support. Our nation has much to gain from a close and friendly personal relationship between the military and civilians in the fields of communications, electronics and photography. Your support of and, if possible, active participation in AFCEA activities will help much in achieving this goal."

Mr. Mosley states that it is too early as yet to determine the results of this project, but at least it is positive action in the right direction. It is contemplated to have the Chapter Presidents report results of renewals directly to the Regional Vice Presidents.

Mr. Mosley's action carries out the recommendation, made at the September meeting of the Directors, to bring our Regional Vice Presidents and Chapter Presidents more directly into AFCEA affairs and responsibilities.

Walter Pagenkopf, Vice President of Region E, reports many active contacts with all chapters in his region and personal effort to enlist new sustaining, group and individual members.

Region F Vice President Ray Meyers reports that the Santa Barbara chapter has inaugurated a program to interest high school students in science. Mr. Meyers has sent copies of the Santa Barbara Chapter's science program to the other chapters in his region. Santa Barbara Chapter President Clarence C. Ray and 1st Vice President Holman H. Dillard have also forwarded copies of their "Project: Recruits for Science" to National Headquarters. Their program was inaugurated on December 11 at a meeting with representatives from industry, high schools and civic organizations. Since the program has great merit, SIGNAL is publishing it in its entirety so that it may serve as a guide for other chapters interested in a similar project.

#### **Project: Recruits for Science**

Santa Barbara Chapter, the latest one to be chartered by AFCEA, has now had time to survey the work of other chapters, and to consider how its efforts may best be employed to further the aims and purposes of the Association. It is the opinion of our membership that:

- (a) Regularly scheduled meetings with speakers, field trips, and other methods of bringing together the

members and discussing mutual problems are well worth while, and our Chapter expects to engage in these activities. However, since the Santa Barbara area contains so many organizations devoted to similar activities, we feel additional projects are needed here, to keep up the interest and promote the best efforts of Santa Barbara Chapter, AFCEA.

(b) One of the greatest services our Chapter could render in this area would be to promote interest in scientific, engineering and technical studies among the high school and junior college students, and to counsel with them about the selection of science or technical majors when they go to college.

We have observed that educational efforts of other Chapters are mainly confined to giving awards to college students for excellence in electronics and communications subjects which we think are excellent. However, we desire to carry this endeavor further back in the student's course, and reach him before he has elected his college major, in order to obtain more "Recruits for Science."

#### **Purposes and Objectives**

We are embarking on this project, with an outline of plans and procedures as follows:

(a) To provide counseling information to high school and junior college students on scientific, engineering, and technical courses of study.

(b) To show these students the great need for scientists, engineers and technicians, if our country is to keep her place in the complex world of today and tomorrow.

(c) To arouse interest in these studies by showing how a new development evolves from an original idea to the completion of a useful instrument, and by indicating how the student may prepare himself to take a part in this process.

(d) To impress upon the individual the necessity for higher levels of training and education, in order to maintain and improve modern production and management techniques.

#### **Duties**

**Chapter President:** Appoints the Project Committee, consults with and advises it on schedules, team presentations, publicity, reports, and all other matters where necessary or desirable. Works with Board of Directors in formulating policy, and works with committee through Project Director.

**Project Director:** Has charge of the teams that make the presentations to high school and junior college classes, consults and advises with the team members on their part in the presentations; reviews their manuscripts, and has authority to change or rewrite such scripts in collaboration with the team members. Arranges schedules for teams' appearances at schools, and has authority to work with school principals and teachers for this purpose. In

## **Reports from Regional Vice Presidents**

general, organizes and directs the work of the teams.

**Chapter Secretary:** Does all the secretarial work for the committee and teams.

**Reporter:** Makes all reports, as directed by the Chapter President or Project Director. Handles all publicity in local press, in SIGNAL, in other chapter areas, and elsewhere as directed by the Chapter President or Project Director.

**Team Members:** Make the presentations to the schools, or elsewhere, as arranged and directed by the Project Director, as outlined in the following paragraph on procedure.

#### **Procedure**

When appearing before a class in school, the time will necessarily be limited to a maximum of 50 minutes. This will require careful planning of time and subject matter, so as to give proper emphasis to each part of the presentation. Since this must be worked out by the team members in collaboration with the Project Director, no rigid outline of what is to be said by whom can be laid down here. However, in line with the stated objectives of the program, the three parts of a presentation are intended to accomplish the following:

(a) Arouse the student's interest in the production and use of communication, electronic, photographic and space age equipment.

(b) Show him how, with proper education and training, he can become a producer and/or user of such equipment, thus serving his country in time of need while building an interesting, satisfying and prosperous life for himself.

(c) Counsel with him and advise him relative to college attendance with a major in scientific studies, so as to prepare himself to take his proper part in the advancement of science and technology.

(Continued on page 47)

## NEW MEMBERS

Listed below are new members of the AFCEA who have joined the Association during the month of November. Members are listed under the chapter with which they are affiliated.

### Arizona

Maj. Daniel Levine

### Atlanta

Lt. Col. Eliot C. Tobin

### Augusta-Fort Gordon

M-Sgt. John E. Bell  
Capt. William E. Branch  
M-Sgt. Scy W. Akridge  
Capt. Shelley F. Watson  
1st Lt. William L. Pearce  
Paul W. Brown  
SFC James D. Ammons, Sr.  
Leland J. Malchow  
M-Sgt. Harold Long  
SFC Sidney A. Fox  
S-Sgt. Claiborn L. Cooley  
M-Sgt. John C. Carter  
Sp-5 Dan H. Reynolds  
SFC James J. Richey  
Thomas J. Carswell  
Ken M. Belcher  
M-Sgt. Byron G. Anderson  
Joseph D. Wright  
M-Sgt. Carl W. Taylor  
SFC Farrell L. Sivils  
SFC John L. Simenot  
M-Sgt. Charles H. McCrary  
SFC Frank A. Boyd  
CWO-W2 James F. Wheeler  
Louis H. Sherwood  
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Brian J. Mulherin  
Capt. Robert T. Hawk  
Sp-4 Robert C. Simpson  
Capt. Frederick K. Walter  
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Ernest L. Nicholson  
Albert D. Cromer  
Sidney M. Trimmier  
Lt. Glenn A. Leister  
1st Lt. John N. Nash  
1st Lt. Frank W. Marr  
1st Lt. Dawson L. Burton  
1st Lt. John J. Falbo  
1st Lt. James H. Carter  
1st Lt. Thomas P. Harvard  
M-Sgt. Keith Pase, Jr.  
M-Sgt. Charles L. Valentine  
CQM William G. Schafer  
M-Sgt. Wilbert L. Dripps  
M-Sgt. Charles L. Grace  
M-Sgt. Chester F. Burnette  
Capt. Lauren L. Lawlis

### Baltimore

SFC Clyde F. Williams  
Francis X. Seibold  
Thomas R. Butschky  
Reginald R. Ward  
John M. Robinson  
Allan H. Burns, Sr.

### Boston

Carl W. Alsen  
William J. Greaser  
Stephen P. Brainard  
Leo Chudigian  
Richard J. Curran  
Joseph S. Fagone

WO Robert E. Wiegand  
Hillard W. Welch  
Robert A. Fantasia  
Charles D. French  
John J. Flynn  
Robert S. Golden  
Paul F. Latour  
David P. Lepore  
Paul J. McNamee  
James P. Melone  
Edward B. Nardone  
Roger E. Robichau  
Fred A. Swartz  
Richard J. Bolduc

### Chicago

Joseph E. Goode  
Eugene Wack  
Harry L. Huntsinger  
Carl E. Rogers  
Ray W. Herrick  
J. Urben Farley  
Clarence M. Bernsten  
Robert W. Conradi  
William C. Eddy  
Mildred M. Schreck  
W. P. Hollis  
Edwin C. Coulombe  
James O. Rogers  
Col. John C. Cook  
Lt. Col. John P. Spickelmier  
Ray M. Schultz  
Edward F. Guzik  
Royal J. Higgins  
Sam Demuro  
Walter C. Rokosz  
George M. Deters  
Col. Donald M. Wright

### Dayton-Wright

Jeremy K. Schloss

### Decatur

Albert E. Halbrook  
Michael V. Coopridner

### Detroit

Howard R. Scott  
William C. Chesney  
Wells Chapin

### Fort Monmouth

Capt. James W. Stewart  
Irving Guttman  
Irving L. Perlman  
Howard L. Coleman  
Morton Bessel  
Joe A. Quartaro  
William Ussler, Jr.  
William H. Godel

### Frankfurt

William J. Dobberstein  
Maxwell J. Richards

### Gulf Coast

LCdr James J. Anderson  
Joseph F. Carmel  
Orville E. Gilbertson

Alguiro R. Kraswisky  
1st Lt. Hollis C. Tinsler  
M-Sgt. Albert A. Sukuris  
Mary H. Porter  
Lt. Col. Eugene H. Field  
Capt. William H. Sample  
Maj. Linton T. Floyd  
Maj. Wilber R. Hill

### Hawaii

Joseph D. Dugas

### Kansas City

Charles C. Minx  
Harry Van Leuven  
George F. Franklin

### Lexington

Jam. Durward T. McKee

### London

D. W. Rees  
Alfred G. L. Mason  
Maj. James M. Kirk  
Frank H. Taylor  
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Cdr. John P. Foster  
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J. G. Adam  
R. T. Duck  
E. Hayes  
Sqdn. Cdr. D. G. T. Hayes  
R. J. Mitchell  
Col. C. Powell  
J. Vickers  
W. St. J. White

### Louisiana

Maj. Leroy Z. Salter

### Montgomery

Horace H. Tucker

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Maj. John P. Schatz  
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C-1st Lt. Joel W. Darrow  
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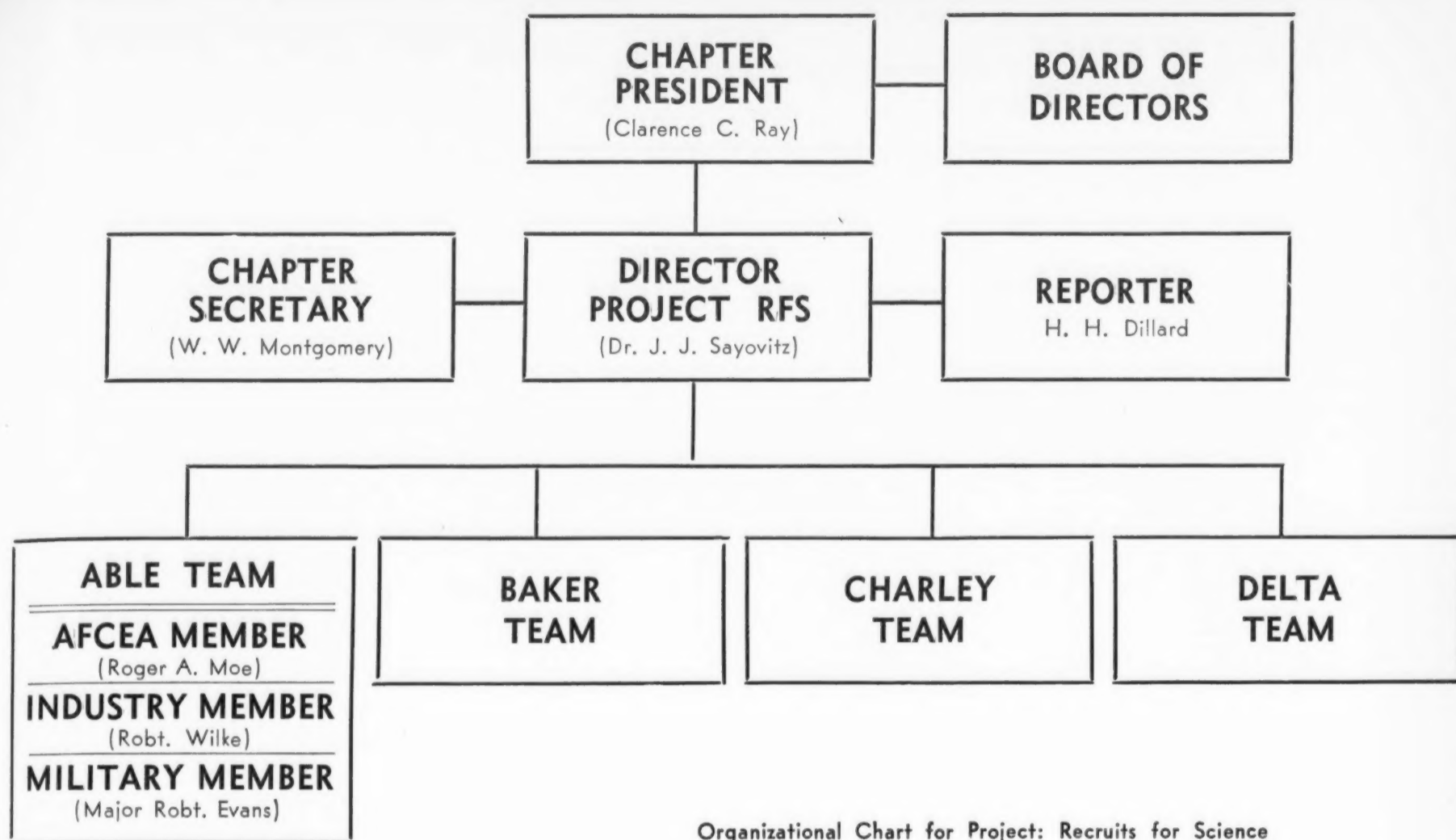
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Organizational Chart for Project: Recruits for Science

With these objectives in mind, the three team members will take part in the presentation approximately as follows:

**AFCEA Member—Introduction:** Introduces the AFCEA Project and the speakers, briefs the listeners on what is to be presented and brings the audience to an expectant mood. (Time: approximately 5 minutes.)

**Military Member — Demonstration:** Demonstrates the operation of some interesting item of equipment used by his service, arouses interest in how this

item is made and how the service acquires it, then indicates that the next speaker will explain this. (Time: approximately 15 minutes.)

**Industry Member—Information:** Explains how the equipment is developed, produced and sold to the armed service; emphasizes the work of the scientists in research, the engineers in development and production planning, and the technicians in assembling. Also describes the work of management, clerical and sales personnel. Indicates that the AFCEA member to follow will show how the listener can become a

part of this picture. (Time: approximately 20 minutes.)

**AFCEA Member—Conclusion:** Advises students on courses they may take in college to prepare for a part in the work described, stresses the need for technically trained men and women, cites the rewarding opportunities offered today, and counsels students to continue their schooling through college and to elect courses of scientific and technical study. Concludes the program by an offer of Junior Memberships in AFCEA. (Time: approximately 10 minutes.)

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(Continued from p. 46)

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Ruthledge H. King

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Listed below are the firms who are sustaining and group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

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For complete information on the RCA 501, or to make arrangements for a visit to the RCA 501 Electronic Data Processing Center at Cherry Hill, New Jersey (near Camden), address RADIO CORPORATION OF AMERICA, Electronic Data Processing Division, Camden 2, N. J.



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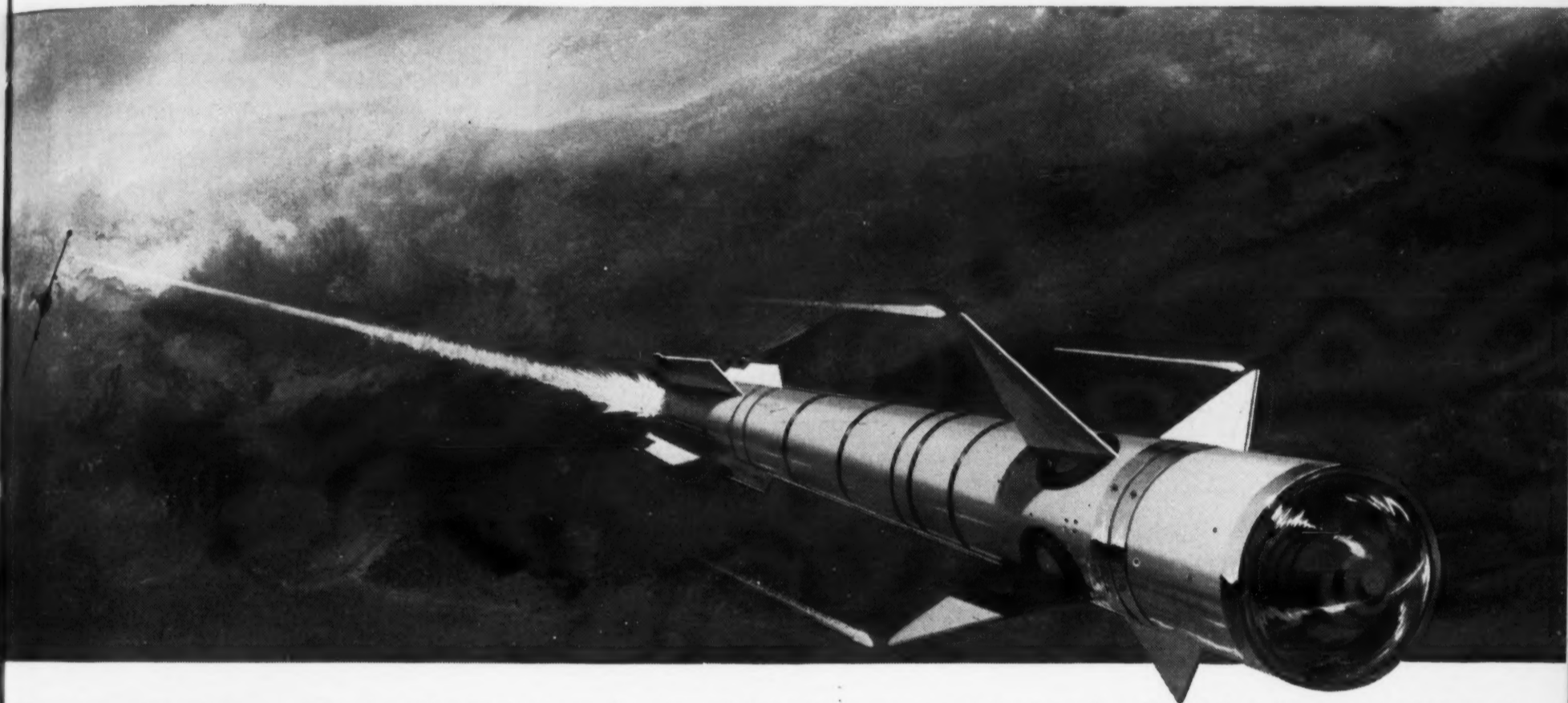
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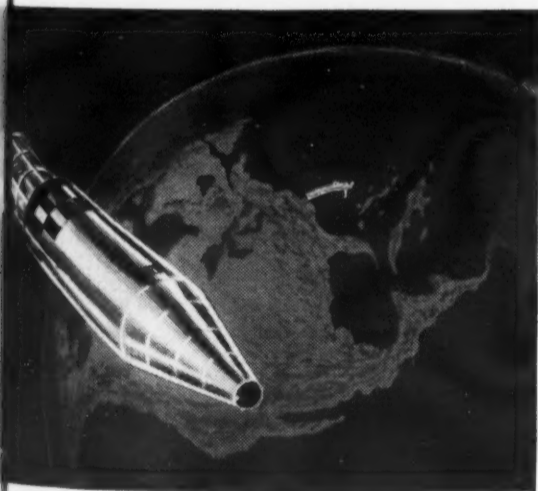
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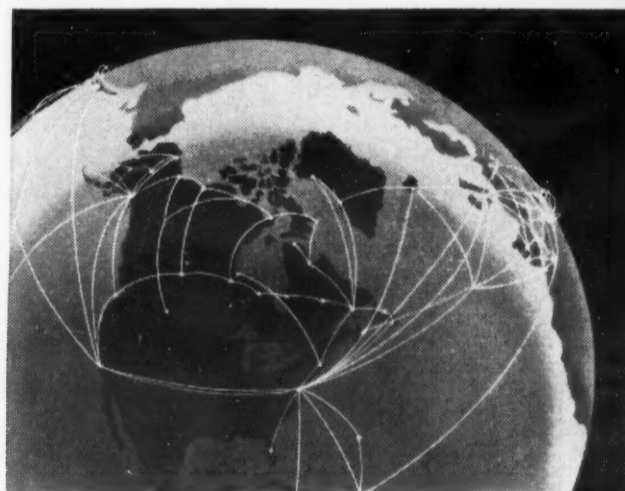
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# Chapter News

## Augusta-Fort Gordon

Craig W. Goodwin, Research Associate at the Eugene Talmadge Memorial Hospital, was the guest speaker at the November meeting. Mr. Goodwin spoke to the group on "Enhancing the Response of Acoustic Records."

## Arizona

On November 18th, San Diego Chapter President Samuel Freedman, USNR (Ret.) came from San Diego to Fort Huachuca to present a 60-slide colorful program on "New Ideas, Materials and Techniques in Electronics and Metallurgy." In addition to the regular members and guests, the city of Douglas, Arizona, 60 miles away, sent four of its officials to hear the presentation.

This meeting was the result of a special arrangement of exchange meetings between the Arizona and San Diego chapters. (See the San Diego chapter report.) The personal interest and cooperation of Brig. Gen. Frank W. Moorman, USA, Commanding General at Fort Huachuca and his officers did much to make both programs particularly worthwhile.

## Atlanta

177 members and guests of the Atlanta Chapter were present at the November 10 dinner-meeting held in the Officers Club at Fort McPherson to hear a most interesting talk by Robert W. Middlewood, Manager of the Nuclear Products Division, Lockheed Aircraft Corp. Mr. Middlewood, introduced by A. W. Webber of Southern Bell, told of Lockheed's contributions to nuclear science and described the unique reactor at Dawsonville, Ga.—the only reactor in service which operates at ground level. Mr. Middlewood also told of his recent visit to Europe to study the reactor market abroad which is apparently as competitive as it is in the United States.

## Baltimore

A dinner-meeting and subsequent tour were the order of the day for the November 17 Baltimore Chapter meeting. The chapter met in the Nuclear Division of The Martin Company for dinner and speeches by Mr. Robert Harvey, Project Engineer and Mr. Larry Burns, Sales Manager, both of The Martin Company's Nuclear Division. Mr. Harvey spoke on "Thermionic Conversion of Heat to Electricity" and Mr. Burns discussed "Portable Nuclear Power Units."

After the meeting, members were conducted on a tour of nuclear exhibits that included the Gamma Pool and a mock-up of the Reactor Flow Loop. *Snap III*, the miniature power unit that was mentioned in the newspapers and shown on television when it was demon-

strated to President Eisenhower, was also seen.

## Chicago

The first dinner-meeting of the chapter, held on September 24, was attended by over 200 members and guests who heard Dean William Everitt of the University of Illinois and a consultant to The Hallicrafters Company speak on "Engineering Education in Russia."

Hosted by W. J. Halligan, Sr., President of the company, members were briefed on Hallicrafters' range of electronics research and development services to the government, with special attention to the company's Quick Reaction Capability program which it pioneered with the Air Force. Hallicrafters' executives also conducted tours and demonstrations through declassified areas of their facilities. An amateur radio station was in operation with a fully transistorized ham receiver and side-band transmitter. The product display ranged from mass-produced, relatively simple short-wave receivers to highly complex industrial and military units and included an all-electronic organ.

## Dayton-Wright

A joint dinner-meeting of the Dayton Wright Chapter, Professional Group on Management Engineering and PGMIL was held October 22 at the Wright Patterson Air Force Base Officers Club.

The principal speaker was Brig. Gen. Joseph R. Holzapple, Commander of ARDC's Directorate of Systems Management at ARDC, Dayton, Ohio. Gen. Holzapple's topic was Weapon Management from the ARDC viewpoint. He spoke about the reliance on complex machines, the necessity of maintaining technical superiority and rising costs and touched on the frequent need for change in an organization that manages things which are in themselves in a constant state of change. 125 members attended the meeting.

## Decatur

The November 24th meeting of the chapter was held in the Decatur Signal Depot Officers Mess where the members and guests saw a program of films of Hawaii. In addition to the program, there was registration for all courses including a new course in transistors offered by the chapter.

## Fort Monmouth

The Army, Navy and industry were well represented at the November dinner meeting of the Ft. Monmouth chapter on November 19th at Gibbs Hall Officers Club. The speaker of the evening was Dr. Hans K. Ziegler, Chief Scientist at the U. S. Army Signal Re-

search and Development Laboratory, who talked on the U. S. Space Program, its results and benefits and some of the expected results of the future.

These would be noted particularly, he said, in the meteorological and communications fields, in advanced weather methods and new world-wide communications means. He showed by statistics that the cost of the space program is dwarfed by over-all expenditures in other major government budgets.

Attending the meeting were Glenn D. Montgomery, AT&T executive who is a Regional Vice President of AFCEA; Col. J. H. Motes, Commanding Officer, Earle Naval Ammunition Depot; Lt. Col. Hollis Lewis, Commanding Officer, Fort Hancock, and Maj. Gen. A. F. Cassevant, Ft. Monmouth Commanding General.

## Gulf Coast

The November meeting of the Gulf Coast Chapter was held at the Airmen's Club, Keesler Air Force Base, Miss. at which 106 members and guests were present. The featured speaker of the evening was Major Relf A. Fenley, Lecturer of the Air University, Maxwell AFB, who gave a most enlightening lecture-demonstration on astronautics.

During the conduct of chapter business it was noted that the Gulf Coast Chapter's membership activity was second only to Philadelphia. Recognition was also given by Lt. Col. Paul C. Kiefer, chapter president, to the Air Force civilian employees and to enlisted Air Force personnel for their active interest in the chapter.

## Kansas City

The November 5 dinner-meeting of the Kansas City Chapter was held at the Officers Club of Richards Gebaur Air Force Base, Mo. Over 100 members and guests were present.

The speaker of the evening, Brig. Gen. H. E. Humfeld, Commander of the 17th Air Division, captivated the audience for almost two hours talking about the various functions of the Strategic Air Command and showing colored slides of various phases of SAC operations and alerts.

Other special guests included Mrs. Humfeld, Maj. Gen. and Mrs. W. W. Bowman and Col. and Mrs. Houston Longino, Jr.

## London

156 members and guests attended the October 29 dinner-meeting of the London Chapter at the Columbia Club, Lancaster Gate. The program consisted of a formal dinner preceded by a cocktail hour in the Regency Room. The dinner was followed by loyalty toasts, dancing

(Continued on page 54)

**Atlanta**—Pictured during the November meeting are standing L to R: Lt. Col. T. A. Pugh; G. M. Sweeney; W. G. Burnett; R. Lawson; A. E. Arnold; D. Hunter; J. S. Seigle; Col. K. Buchak; B. McMahan; Lt. Col. L. J. Ross; and Capt. N. A. Christensen. Seated L to R: F. Garner; A. M. Wilson; E. Ray; M. Wasson; and P. Taylor.



**Boston**—"Communications in the Year 2000" was the subject of an address at the chapter's November meeting. Pictured L to R: James H. Brewster, III, Sylvania Electric Company, Vice President Marketing; Dr. Leonard S. Sheingold, Sylvania Electric Company, Director of Applied Research Lab.; and Col. Sidney S. Davis, chapter president and Chairman, Northeastern University Dept. of Military Science and Tactics.



**Chicago**—Shown at the 1959-60 season kick-off meeting, September 24th are L to R: Lt. Col. D. W. Langham, Army Signal Corps; W. J. Halligan, Sr., Hallicrafters President and Board Chairman; Engineering Dean William Everitt, University of Illinois, main speaker; and R. F. Halligan, Executive Vice President, Hallicrafters Co.



**Dayton-Wright**—Chatting with Gen. Holzapple following the October meeting and congratulating him on his excellent talk are L to R: Maurice Jacobs; Neal Breesman; Brig. Gen. Joseph R. Holzapple; William Shade, chapter president; James Magill; and Thor Holt.



**Northeastern University**—Newly elected officers of the student chapter are L to R: Jerome F. Ryan, Treasurer; Albert V. Short, President; Carroll F. Craft, Vice President; and George E. Lanctot, Secretary.





**New York**—Pictured at the November 18th meeting are L to R: Henry R. Bang, chapter president and J. Carlton Ward, Jr., President, Vitro Corporation of America who spoke on "Some Aspects of Research and Development Today."



**Rome-Utica**—Demonstrating the new equipment developed for the Army Signal Corps to the chapter members and guests at the October 21 meeting, is Hillel Pitlik, left, of Stromberg-Carlson Division of General Dynamics Corp.



**San Diego**—Shown at the November 10th meeting are L to R: Capt. John H. Allen, Deputy Director Navy Electronics Lab.; Lt. Col. William M. Coeyman, USA, Deputy Director, Orientation and Training, Army Electronic Proving Ground, Ft. Huachuca, Arizona; and Cdr. Samuel Freedman, USNR (Ret.), chapter president.



**Tokyo**—Pictured are the new officers for 1959-60. L to R are: Cdr. H. B. Kirkham, Naval Comm. Facility, director; Lt. Col. R. M. Brewer, MAG Japan, director; Capt. W. H. Kreamer, Staff Comm. Nav. for Japan, director; Col. B. H. Wells, USF Japan, president; Col. H. Winter, ELINT Center, treasurer; S. J. Antosy, RCA Far East Manager, director; P. W. Becker, Hq. U.S. Army Signal Comm. Agency, director; and Maj. R. G. Ramsey, 1956 AACS Gp., secretary.

## Chapter News

(Continued from page 52)

and a floor show. The evening was presided over by Col. and Mrs. Plihal. Distinguished guests were: Capt. T. A. Torgenson, USN, Washington, D. C.; Lord and Lady Glanusk; Sir Reginald and Mrs. Payne-Galwey; Gen. and Mrs.

Vulliamy, and Brig. and Mrs. Zweigbergk.

### Louisiana

A dinner-meeting preceded by a social hour were the activities of the November 17 chapter meeting where members met at the Naval Air Station Officers Mess at Alvin Callender Field, Belle Chasse, La. The "Orange Festi-

val Queen" and he rcourt were present for the evening that featured an interesting program by International Business Machine Corp. entitled, "Electronic Computers in Air Defense."

### New York

Mr. William H. C. Higgins, Director of Military Electronics Development, Bell Laboratories, Inc. addressed the

October 28 dinner-meeting of the New York Chapter held at the Hotel Belmont Plaza, on the subject of missile and space vehicle guidance. Mr. Higgins, associated with work on the *Titan* ICBM and *Nike-Zeus* missiles, conducted a most informative discussion on a subject of timely interest to all.

Ben Oliver, National President of AFCEA, was present at the meeting and spoke briefly on the activities of the Association. Also at the head table besides chapter president Henry Bang were: J. J. Hanselman, Assistant Vice President, AT&T; C. C. Duncan, Assistant Vice President, AT&T Long Lines Department; T. N. Pope, Bell Telephone Laboratories and Vice President of the chapter; A. M. Rouse, General Commercial Manager, New York Telephone Co., and D. P. Fullerton, Chief Engineer, New York Telephone Co.

J. Carlton Ward, Jr., President of Vitro Corporation of America, delivered a stirring and thought provoking speech to the chapter at the November 18th meeting in which he indelibly cautioned against U. S. complacency in its program to maintain and create leadership in our research and development endeavors. Mr. Ward cited the need for more government sponsored fundamental research programs to accelerate our military and industrial progress and pointed out the benefits we are enjoying today in the electronics, the atomic and aircraft fields as a result of military efforts in previous national emergencies.

Mr. Ward supplemented his talk with a series of slides which displayed U. S. educational progress in technological areas against that which Russia has made in recent years and compared these advances with our own critical situation due to a dwindling supply of scientists, engineers and technicians as compared to the Russian effort. The bold fact is that Russia is developing almost twice as many technical personnel via current processing through their educational system. He amplified his precautionary remarks on complacency, pointing out that this is the mechanism wherein Russia expects to surpass us in technological ability, and then later, via effective government controlled industry, overcome our dominance in world markets where the U. S. may now hold sway.

Mr. Ward asked every individual to do whatever is possible to encourage our youth toward technological interests in view of our inadequate supply of new engineering talents. The daily increasing military and industrial demands for technical personnel will exhaust our supply in less than ten years to create a sad competitive picture with the anticipated Russian situation if their present plans for technological superiority prove effective.

He firmly cautioned those who are responsible for the planning and development of our sociological patterns not to lack appreciation for what fundamental research and development

has done and must do to create a continuing high living standard. Convincing data was presented to show what small amounts of government sponsored research have done to generate the many sociological advantages we all enjoy today, and if more challenging basic research programs are not encouraged, our position as a prospering world power could be lost to Russia sooner than one dares to believe.

The election of officers and directors of the chapter for 1960 was held at the meeting. The following were elected: president—H. R. Bang; vice presidents—Col. J. Z. Millar, Lt. Col. D. Talley, Maj. T. N. Pope; treasurer—M. G. Nattress; secretary—T. Brown, 4th; membership secretary—Maj. O. S. Ostberg; Executive Committee member—Col. L. R. Engler; Directors—G. W. Bailey, C. Benton, Jr., E. C. Carlson, RAdm. R. W. M. Graham, F. A. Gunther, Lt. Col. W. L. Hallahan, J. V. L. Hogan, W. A. Kirsch, Maj. Gen. F. H. Lanahan, Maj. Gen. R. C. Maude, Col. T. H. Mitchell, G. D. Montgomery, J. W. McRae, C. R. Smith, RAdm. E. W. Stone and J. L. Strauss.

#### North Texas

Following a buffet dinner and business meeting at the November 6 meeting of the North Texas Chapter, held at the Naval Air Station Officers Club, Hensley AFB, Mr. Byrnes, chapter president, introduced Lt. William Newport, the guest speaker. Lt. Newport, a Communication Officer at Carswell AFB, presented a colored slide lecture on "The Mission of SAC." He also described some of the latest unclassified developments in the missile and rocket arsenal.

#### Northwest Florida

The chapter's fall meeting was held at Eglin Air Force Base on October 23. Mr. W. Kelly Mosley, Regional Vice President of AFCEA and Assistant Vice President of Southern Bell was guest speaker of the evening.

Members of the Chapter were given a tour of the communications and missile facilities at Hurlburt Field as part of the November 20 meeting. Communications representatives from the Air Research and Development Command, the Air Defense Command, Southern Bell Telephone Co., Southeastern Telephone Co. and the U. S. Naval Station at Pensacola were present.

The next meeting will be held in January at Panama City.

#### Rome-Utica

A new type of electronic telephone switching system which operates without the conventional electromechanical switches was demonstrated on October 21 to the chapter members and guests.

Meeting at the main plant and headquarters of the Stromberg-Carlson Division of General Dynamics Corp., the members were shown the new equip-

ment developed for the Army Signal Corps. Operating on a "time-division" basis, the system uses transistors and other solid state devices instead of electromechanical switches to complete connections between telephones in the system.

A new type of field telephone, using push buttons instead of a dial and designed especially for operation in conjunction with the electronic switching system, also was demonstrated.

Leading the Rome-Utica delegation were Lt. Col. Michael Bobela and Maj. Joseph Bernard. The group was welcomed at Stromberg-Carlson by Gordon G. Holt, Executive Vice President, Dr. Royal Weller, Vice President in Charge of Engineering, and Gordon Taylor, Rome area representative, who made the arrangements for the visit.

Following the tour of the Stromberg-Carlson plant, the group visited Eastman House, the photographic museum, returning to Stromberg-Carlson for the dinner meeting.

#### San Diego

On November 10th, Lt. Col. William M. Coeyman, USA, Deputy Director of Orientation and Training, Army Electronic Proving Ground, Fort Huachuca, Arizona, presented a slide and motion picture program on "Fort Huachuca and the New Electronic Environmental Test Facility" at the Admiral Kidd Officers Club in San Diego. It was the largest meeting in the chapter's history and attracted many hitherto non-member guests.

The program particularly emphasized in illustrated detail what is to total a \$150,000,000 program of contractual awards to industry for a vast Electronic Environmental and Test Facility (EE-TF) to occupy some 300 miles of geographical area between Fort Huachuca and Yuma, Arizona. It has to do with such problems as the handling of 15,000 or more radio transmitters on the air in a single square mile of battlefield. The cross-modulation, jamming and upsets to communications, radar, drones and radio controlled vehicles is a challenge to some 140 electronic firms throughout the nation which have been invited to bid. Several area firms were represented at the meeting.

It is reported by chapter officers that the chapter increased its membership more than 10% as a result of the favorable impression that the meeting created for AFCEA.

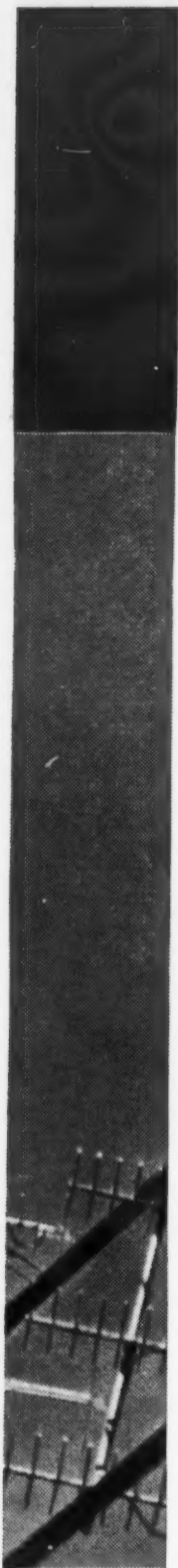
#### San Francisco

A "Krushchev Tour" of International Business Machine Corp. San Jose plant was the special event of the November 19 meeting. The tour followed dinner in the IBM Cafeteria and lasted about 1½ hours.

#### Scott—St. Louis

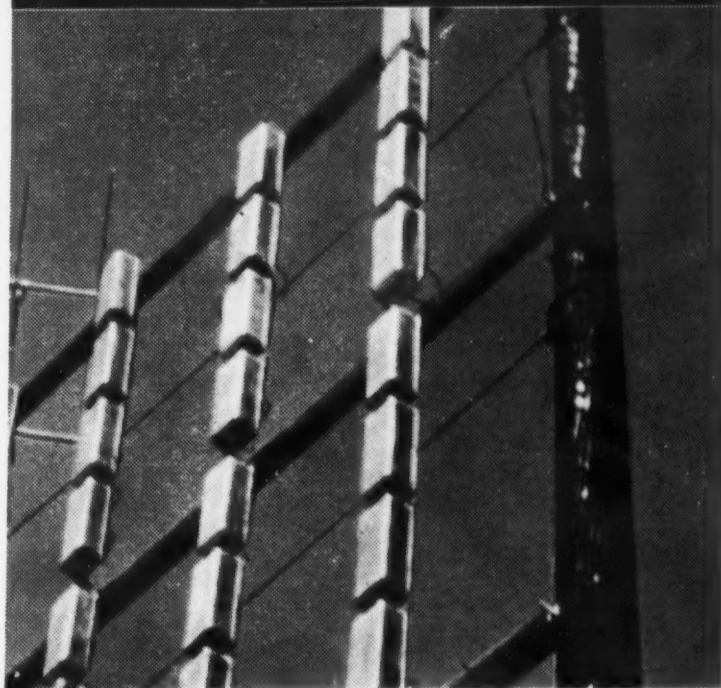
Members of the Scott—St. Louis chapter met for their November 6 meeting at the Cyclotron, Washington

(Continued on page 66, col. 2)



ingenuity in design...  
reliability in the product...

## MISSILE BASE VIDEO COMMUNICATIONS



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A missile base video communications system . . . for monitoring launchings . . . and TV broadcast.

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Complete launching picture is relayed to translator system for rebroadcast. Viewing at strategic points eliminates need for key personnel at launching pads.

System also provides multi-channel TV reception for base personnel by rebroadcasting programs of distant TV stations.

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Career opportunities are available at all engineering levels. Write to Personnel Director.

## Influence of Nuclear Technology

(Continued from page 10)

started their ballistic missile program so much earlier than we—why are they so far ahead at this moment.

It is my opinion that Soviet concern over their nearby European neighbors in relation to their particular geographic location prompted them to commit their resources in this direction, just as our geographic situation dictated a different course for us. In this area they hold an advantage we cannot easily overtake.

As I have said, a technological achievement once accomplished tends to grow and I am sure that the best of the Soviet scientists and engineers are working feverishly to expand and improve this system, which they have so successfully developed. New and spectacular accomplishments are certain to follow those already accomplished by them.

From an acknowledged late start, for the reasons I have mentioned, our own effort in space is becoming massive. When the military part of the investment is added to the exploratory and scientific missions being assumed by the National Aeronautics and Space Administration the United States space budget reaches upward into the billion dollar a year category.

Is a billion dollars a year enough? That depends, it seems to me, upon what we expect to gain from space.

I wonder, however, whether we have really thought through the requirements of space.

Space is infinite. The resources of this nation—in fact the resources of all nations of this earth are finite. The first revelations of what is possible have produced a kind of an intoxication and a burning desire to get along with programs because they appear feasible, but without regard to the enormous complexity and inestimable billions in cost.

What faces us is an old dilemma. Obviously there can be no turning back in this new and exciting field. We must go on. We must divide our human and our capital resources concentrating on that which is essential and carefully separating it from that which is merely intriguing or desirable. We must measure our investments in the essential features of space and remember that it behooves us also to attend to our earthly needs as well.

First, we must be sure that our methods of selecting our technical goals are sound and correct. Here the guidelines of essentiality must be  
(Continued on page 66)

# Precision Tracking Beyond The Ionosphere

With the advent of more powerful and longer range missiles traveling at much higher speeds came the need for a new tracking system . . . one with precise stability to measure the velocity and position of guided missiles in the regions of space beyond the ionosphere. The answer was the UHF UDOP system. UDOP transmitters manufactured by Gates are now in use tracking guided missiles far above the surface of the earth with exact precision.

In addition to UDOP, the Army Ballistics Missile Agency has also called on Gates to build VHF transmitters for the DOVAP system. Used in the same application as UDOP, but at altitudes below the ionosphere, Gates DOVAP transmitters are in operation at many of our country's missile testing sites.

Your inquiries regarding special projects for the military are invited. Let Gates demonstrate its ability to meet your most exacting requirements with speed and accuracy. Contact the Gates Government Contract Division today.

Shown below is the Gates M-5687-Radio Frequency Reference System (UDOP).



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**GATES**

# NEWS ITEMS AND NEW PRODUCTS

Reports on three of the most widely discussed subjects in the electronics industry—tunnel diodes, low noise amplifiers and multi-functional devices—highlighted the 1959 Electron Devices Meeting held in Washington, D. C., last October. Dr. Esaki, Japanese inventor of the tunnel diode, and more than 1000 leading electronics specialists from across the nation attended the meeting which was sponsored by the Professional Group on Electronic Devices, Institute of Radio Engineers.

Dr. R. N. Hall of General Electric Research Laboratory presented a paper on the Esaki, or tunnel diode and Professor H. Heffner of Stanford University presented a report describing several of the competing device concepts for achieving low noise in solid-state and other electronic amplifiers. Low internal noise performance is vital in improving the respective range characteristics of communication systems.

Dr. I. M. Ross of Bell Telephone Laboratories presented a paper dealing with the broad field of multi-functional solid-state devices. These devices are being investigated from a number of approaches, including those known as micro modules, solid circuits, molecular electronics and micro-miniaturization. An initial objective has been to eliminate connective circuitry between individual components.

Frederick R. Lack, currently Director of the Electronic Industries Association and formerly Vice President and Director of Western Electric Co., Inc., as well as past President and Director of AFCEA, was the speaker at the opening-day luncheon. Summarizing the past and present status of electron tube development, Mr. Lack warned his audience against the pitfalls of moving too fast in adapting newly-developed electronic devices in expanding markets.

"Our experience with vacuum tubes between World Wars I and II should illustrate that seeking to mass produce a device before it is fully proved can lead only to heartaches," Mr. Lack said. "Every new-born electronic component, vacuum or solid-state, must undergo rigorous training and post-graduate laboratory study before it can stand up to the cold, cruel requirements of today's commercial and industrial applications," he added.

William S. Parsons (Right) of Milwaukee, president of Centralab Division of Globe Union, Inc., presents a plaque mounted with the 100 millionth packaged electronic circuit to David R. Hull of Washington, D.C., president of the Electronic Industries Association and vice-president and manager of the Equipments Division of the Raytheon Co. The presentation was made at a dinner in the Statler-Hilton Hotel, Washington, D. C.



William S. Parsons, president of Centralab of Milwaukee, the electronic division of Globe-Union Inc., recently presented the 100,000,000 PEC packaged electronic circuit produced by his company to David R. Hull, president of the Electronic Industries Association. The unit, especially mounted for the occasion, symbolized the impact of packaged circuitry on the electronic industry in the years since Centralab originated its basic concept and techniques.

In making the presentation, Mr. Parsons recalled the days of World War II when Centralab was requested to develop printed circuitry for military's radio proximity fuse. This self-powered complete mortar fuse with the approximate volume of a half-pint bottle was considered the second most important secret weapon of the war, giving precedence only to the atomic bomb.

"We saw it grow from a laboratory curiosity into a prominent product position. Today there are numerous names used for the basic idea. Perhaps the most all-embracing is the use of 'Modular Concept.' We call our approach 'Packaged Electronic Circuit,' or PEC for brevity and to avoid confusion with other systems. But all spring from this infant developed for the miniaturized proximity fuse," Mr. Parsons stated.

Mr. Hull pointed out that Centralab's development of packaged circuitry had added a vast new scope to the growth of electronics—by subtracting.

"In developing a method of creating an electronic component assembly with length and width but virtually no depth, Centralab practically eliminated the third dimension," Mr. Hull said, "opening the door to the era of miniaturization in electronics."

Packaged circuitry has enabled industry to miniaturize a host of military and civilian products, including such familiar ones as hearing aids and portable tape recorders. Guided missiles and electronic computers also utilize PEC circuits in their construction.

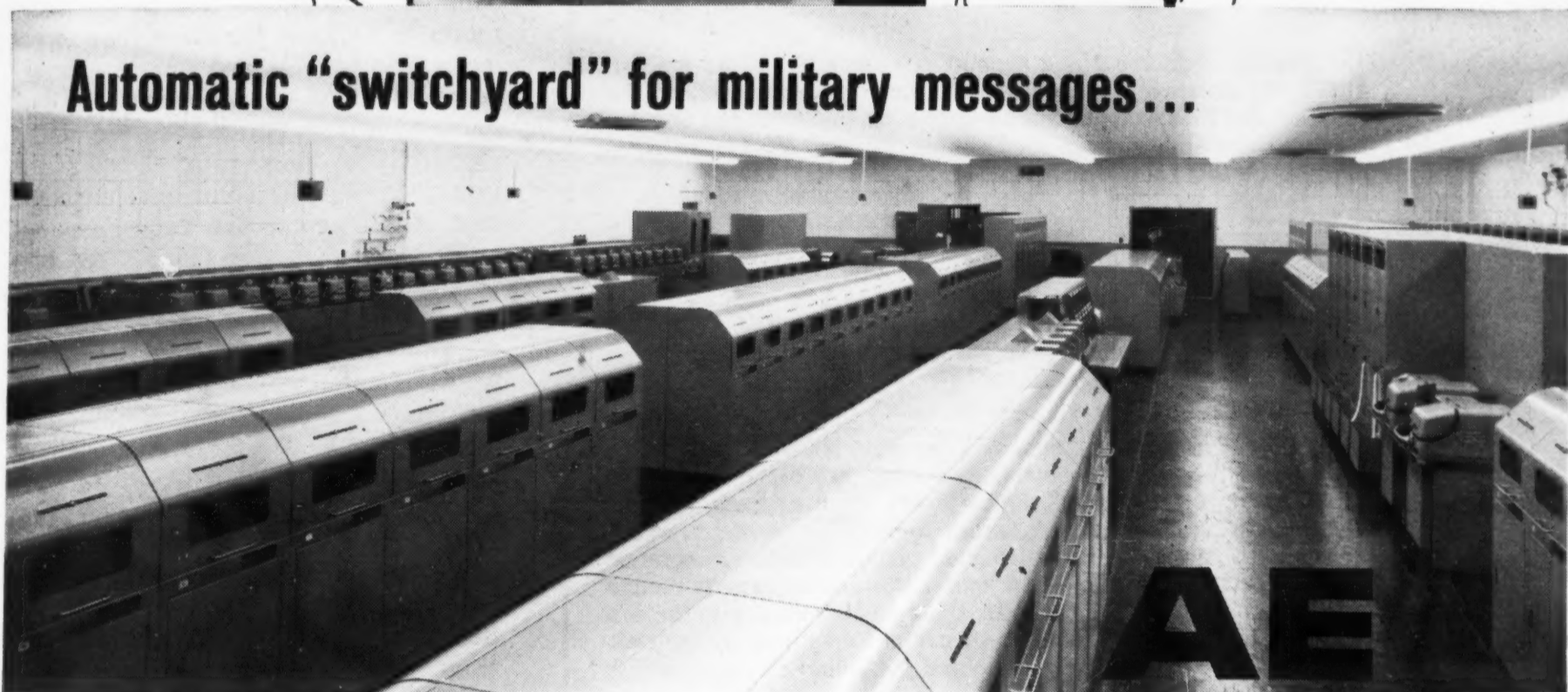
The plaque, bearing the PEC circuit, will be presented at a later date to Dr. L. Carmichael, Secretary of the Smithsonian Institution, to be housed in the new electronics' wing.

Last September the U. S. Army Signal Corps displayed for the first time an exhibit oriented directly to procurements. A display at the Great Lakes Exhibit in Fort Wayne, Indiana, was constructed consisting of several panels and an information office; on exhibit were several current radio transmitter-receivers, a field switchboard, a radio-sonde, a solar cell unit and parts of these units broken down in order to provide a complete view of the major components.

An electronic and mechanical packaging display was constructed which depicted the various packaging methods and how they tie in with the new codes of the Sig Pak Manual.



## Automatic "switchyard" for military messages...



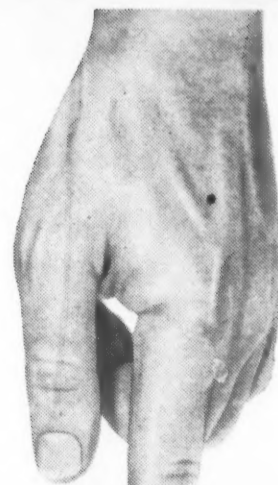
Teletypewriter Switching Center at Davis, California

AE has developed the switching techniques and control devices that automatically route messages to the proper commands, give instant priority to emergency traffic.

Messages arrive at Teletypewriter Switching Centers on coded tape. The codings indicate whether messages have a single or multiple destination, where they are to go, and the degree of their priority. AE automatic switching systems do the rest.

Switching such as this is AE's business. If you have a tough project in communications or control, AE is ready to take it on. Just write the Manager, Government Service Division, Automatic Electric Sales Corp., Northlake, Illinois.

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AUTOMATICALLY



# SYSTEMS ENGINEERING

and

# SYSTEMS MANAGEMENT

The strategic battlefield and support requirements of the modern **ARMY** for mobility, communications, and dispersion require the broadest and most sophisticated engineering solutions. The General Electric Company, through its **SPECIAL PROGRAMS SECTION**, is now staffing to meet this critical need.

Within SPS, a technical team has been created to focus all of General Electric's varied technical capabilities on the solution of the Army's requirements. Its small numbers afford maximum freedom and informality and permit an unequalled flexibility in responding to the Army's needs with advanced systems concepts and systems management approaches.

In staffing our technical positions we have chosen men of the highest ability and achievement; men who have broad experience in various facets of their technical fields. Each of them sees his discipline as an elemental part of the whole system and conversely, recognizes that the most sophisticated system is but an integration of complex technologies. Many hold advanced degrees (although this is not a prerequisite). Most are thoroughly familiar with the new Army's requirements (again, not essential). All thrive on the challenge of building a vital new group and the unlimited opportunities which it presents.

A limited number of these opportunities still exist — all at the senior level. Included are positions in **MISSILE ENGINEERING, WEAPONS SYSTEMS ENGINEERING, COMMUNICATIONS, MICRO-WAVE & RADAR, NAVIGATION & GUIDANCE, PASSIVE DETECTION, DATA LINKS, NUCLEAR WEAPONS EFFECTS, AEROBALLISTICS,** and **SYSTEMS ANALYSIS.**

Confidential interviews will be arranged very shortly for qualified candidates with our Manager of Engineering or our Manager of Electronics Engineering. Interested individuals should direct their response to:

Dr. W. Raithel, Manager—Engineering  
Special Programs Section, Dept. 318  
**GENERAL ELECTRIC COMPANY**  
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\*The Special Programs Section moves in February 1960 to a completely new facility on the Main Line—Philadelphia's finest and one of the country's most attractive suburban locations.

**SPECIAL PROGRAMS SECTION** **GENERAL ELECTRIC**  
DEFENSE SYSTEMS DEPARTMENT

A Department of the Defense Electronics Division

Cut-away models of teletypewriter packaging and of radio equipment packaging were also exhibited.

A similar Exhibit of Business Opportunities was held in Birmingham, Alabama in December by the Signal Corps.

• • •

The Defense Advisory Committee on Women in the Services (DACOWITS) was established just a little over eight years ago by the Secretary of Defense.

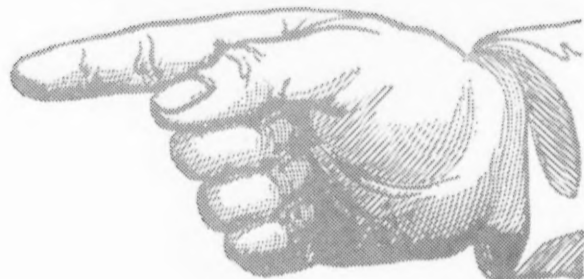
DACOWITS is made up of civilian women who are selected as members on the basis of their outstanding reputations in business, a profession, or in public service and their records of civic leadership. Members of the committees are appointed by the Secretary of Defense for three year service as individuals and not as official representatives of any group or organization with which they are affiliated. Each member endeavors to increase public acceptance of the concept of military service for women as a facet of good citizenship. To this end, the committee develops and carries out a continuing and unified education program in behalf of all women in the Services and promotes the understanding of the principal need for women in the Armed Forces in peacetime—to maintain a nucleus of trained women to serve as the framework for absorbing thousands of women and utilizing their capabilities effectively and quickly in case of the necessity for national mobilization.

The committee advises the Department of Defense on policies relating to women in the Services, recommends measures to bring about a more effective utilization of the capabilities of the women in the Services and recommends standards for their training, housing, health, recreation and general welfare. As part of this program, DACOWITS has recently published a brochure, *For You, An Officer's Career in the U.S. Armed Forces*, to inform young college women of the vocations enjoyed by our women officers. Some of the career fields discussed are administration, personnel, public information, legal and legislative and communications and intelligence.

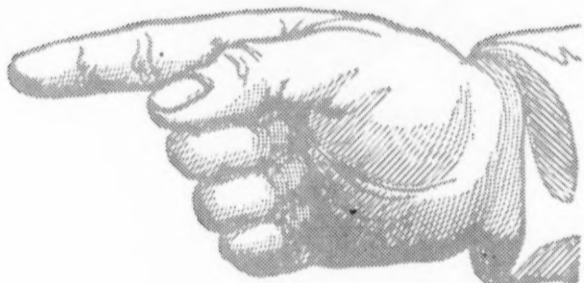
Women officers have been found particularly efficient in the field of Communications and Intelligence. Sometimes a newly-minted officer finds herself a "watch officer," putting to practical use all that she learned of communications during training. On later assignments, she may supervise a central-telephone exchange, or see that messages from half around the



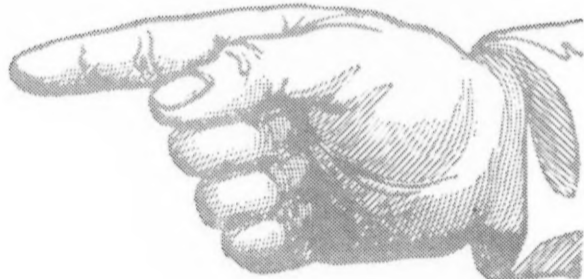
**A FLICK OF THE FINGER**



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**FOR 120 CONTINUOUS HOURS**



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and other government agencies, commercial air lines, weather reporting services, geophysical divisions of major oil companies.

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world are swiftly and accurately decoded and delivered to the proper persons—at any hour of the day or night—assignments requiring steady nerves, a sharp sense of accuracy and sound judgment.

• • •

**Bureau of Ships, USN,** awarded a contract increase of approximately \$2 million to the National Company, Inc. of Malden, Mass. for an additional quantity of ultra stable radio receivers, designated the AN/WRR-2. The original contract (prime) for \$5.5 million was awarded to National in February of 1959.

The AN/WRR-2 receiver has been designed to meet the needs of the Naval Ship and Shore Communication Services. According to the company, the outstanding feature of the electronic and mechanical design of the receiver is that it provides complete flexibility to meet the varied and constantly changing demands imposed by the many modes of Naval communications. These demands are met in such a manner that the high standard of performance required by one mode of reception is not achieved by the compromise of the performance standards necessary to any other mode of reception. For example, high performance on single sideband is not obtained at the expense of reduced performance on double sideband.

Although the receivers are for surface and underwater craft use, they can be used in mobile communications and missile tracking. They are designed for reception of keyed radio telegraphy, AM radio telephone, frequency shift keyed teletype, facsimile signals and single and double sideband reception. They are tunable in 1.0 kc steps and are accurate to plus or minus 3 cycles or less throughout a tuning range of 2 to 32 megacycles. The receiver also affords facility for continuous tuning throughout its frequency range.

• • •

**On January 6, The First U.S. Army MARS SSB Technical Net** will celebrate its second anniversary. During two years of operation, the net has presented sixty-three talks and forums by electronic scientists and engineers from many parts of the country.

In order to expand the activities of the net in the Boston area, Colonel Clinton W. Janes, W4KS/1, of Acton, Mass., was appointed an associate net director for the section. Colonel Janes, who is the U.S. Army Signal Corps liaison officer at the M.I.T. Lincoln Laboratory, will make ar-

rangements for originating a speaker each month from the reservoir of electronic talent in his section.

The net, operating each Wednesday evening at 9 PM EDT on 4030 kc upper sideband, has scheduled the following speakers for February.

February 3: "Application of Quartz Crystals in SSB Filters," by W. E. Benton, Div. Chief, Manufacturing Engineering, Western Electric Co., Andover, Mass.

February 10: "Design Philosophy of a Modern SSB Transceiver," by Chuck Carney, Manager, Amateur Equipment Sales, Collins Radio Co., Cedar Rapids, Iowa.

February 17: "Harmonic and Intermodulation Distortion in High Fidelity Amplifiers," by Milton Snitzer, Technical Editor, Electronics World, N.Y., N.Y.

February 24: "High Power Transmitter Stations," by Herbert C. Hawkins, Proj. Engineer, Long Range Radio Branch, U.S. Army Signal Development Lab., Fort Monmouth, N.J.

• • •

**At Groton, Connecticut,** on November 10, 1959, the nuclear submarine *Triton* was commissioned into the fleet of the United States Navy. The submarine, designed and built by General Dynamics Corporation's Electric Boat Division, is the largest and most powerful of any submarine to date. In length, the SS(R)N-586 *Triton* measures 447 feet, 100 feet longer than any conventional destroyers, and displaces 5,900 tons. It was built at a cost exceeding \$100 million. The SSN-571 *Nautilus*, the world's first nuclear powered submarine and commissioned in September 1954, is 320 feet long, displaces 3,000 tons and cost approximately \$55,000,000.

To fulfill its function as that of a mobile, invulnerable, early-warning listening post for a fast carrier task force, the *Triton* is equipped with radio, radar (with a range of approximately 500 miles), and sonar. This equipment, which accounts for the size of the submarine, enables the *Triton* to spot enemy aircraft, submarines, and naval vessels and to alert the task force which then will attempt interception by fleet fighter planes or missiles. A 40-line telephone switchboard and electric power generating equipment are also aboard the submarine. The switchboard replaces sound-powered communications equipment.

To ensure the *Triton* mobility, speed and reliability, twin nuclear reactors are utilized, each capable of producing higher shaft horsepower

than any other submarine power plant ever built and each capable of propelling the submarine without the other, if necessary.

The reactors are pressurized water cooled, designated type S3G, and were designed and developed by the Knolls Atomic Power Laboratory, Schenectady, N. Y., which is operated by the General Electric Company for the Atomic Energy Commission. Knolls is also responsible for the experimental sodium-cooled reactor, type S2G, which successfully powered the SSN-575 *Seawolf* for nearly two years.

In the pressurized water cooled reactor system, which is now the standardized system for Navy reactors, heat produced by nuclear fission is passed into water and carried from the reactor to an exchange point where the heat energy produces steam to operate a steam turbine plant.

Besides its high power producing capability, the S3G reactor has other valuable design advances. It is compact and relatively light—it has lower weight per shaft horsepower than any other nuclear submarine propulsion unit. The use of unit-cell core construction, an arrangement of separate and distinct unit cells making up each reactor core, permits in-hull refueling through a small hatch in the hull. This permits refueling at sea and thus saves about four to six weeks in refueling time over other present nuclear submarines which must be refueled at dockside to utilize heavy equipment necessary to open the hull and remove the complete core. The General Electric Company estimates *Triton's* cruising range at 110,000 miles, or almost two years without refueling. Since the submarine can be refueled at sea anchorage, she will be able to remain on duty an indefinite length of time.

The reactor also utilizes twisted ribbon type fuel elements which supply increased heat transfer efficiency over plate-type fuel elements.

The *Triton's* importance goes beyond the specific military task which has been assigned to her. The *Triton*, skippered by Capt. Edward L. Beach, is putting into operation an advanced type nuclear propulsion plant and will pave the way for submersible capital ships of the future.

• • •

**An examination of statistical methods** and problems encountered in the analysis of research and development manpower and costs has been issued by the National Science Foundation.

The publication, *Methodology of Statistics on Research and Development*, consists of proceedings of a

special session on R&D statistics conducted during the American Statistical Association annual meeting in 1958. It includes four papers presented at the session and the resulting discussions.

Dr. Jacob Perlman, Head of the Office of Special Studies of the Foundation, has written an introduction. Appendices consist of a selected bibliography of R&D surveys sponsored by the Foundation and sample questionnaires and instructions used in current surveys conducted by NSF.

Copies may be obtained from the Superintendent of Documents, Washington 25, D. C. at \$1.25 per copy.

• • •

The following publications are currently available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

The *Navy Reliability Design Handbook* (formerly entitled, *NEL Reliability Design Handbook*) provides information on ways to achieve simplicity, economy and reliability in electronics equipment for the Navy. The handbook, PB 121839, is published by the U. S. Navy Bureau of Ships and is available at \$3.00 per copy. Seven Supplements, PB 121839-S1 through PB 121839-S7, October 1957 through October 15, 1959, are also available at 75¢ per copy.

*Apparatus for Measurement of the Magnetic Threshold Curves for Superconductors* describes equipment devised for superconductors in the liquid helium temperature range. The report, PB 151877—March 1959, was prepared by J. G. Daunt, The Ohio State University Research Foundation for Wright Air Development Center, U. S. Air Force and costs 50¢ per copy.

*Basic Research in the Navy* is based on findings of a two-year investigation of basic research effort by U. S. industry, government and universities. It was prepared for the Naval Research Advisory Committee by Arthur D. Little, Inc. and sponsored by the Office of Naval Research. The committee believes the study, "breaks new ground in applying new methods for measuring the amount of basic research that is done, illustrating the mission orientation of basic research in the Navy, and depicting the anatomy of basic research." The report, PB 151925—June 1959 is available at \$7.00 per copy.

*An Analysis of Propagation Measurements Made at 418 Mc Well Beyond the Radio Horizon*, PB 151365, is available at \$2.25 per copy. Prepared by National Bureau of Standards physicists, H. B. Janes, J. C.

Stroud and M. T. Decker, the report sets forth an analysis of measurements of transmission loss (signal strength) at 418 Mc over 134-mile path. Continuous simultaneous recordings of signal level were made at receiving antenna heights ranging from 30 to 665 feet. The data are reduced to tabulations of hourly median values of basic transmission loss and fading range. These values, as well as the hourly difference in transmission loss observed at two heights (height-gain), are plotted against time of year to show seasonal variations. A formula developed at NBS for predicting the median basic transmission loss in tropospheric scatter propagation is shown to be in good agreement with the data. Results of a study of the correlation of short-term signal variations at horizontally and vertically spaced antennas are also given.

## Photoprogress

An oscilloscope camera which records full-sized oscilloscope patterns without distortion on Polaroid Land film is available from Hewlett-Packard Co.

The camera, Model 196A, uses a standard camera bellows to eliminate light leakage. Lens adjustments may be made without removing the camera from the scope.

Weighing only 9 pounds, the camera is equipped with a special "quick-look" tab for easy, one-hand mounting on the scope. While making an exposure, the operator can observe the pattern with both eyes.

• • •

Clear moon photos have been obtained by using Telefold lens, a new instrument developed by Atlantic Research Corp., Alexandria, Va. The lunar pictures were taken by using the lens at its longest focal length position—75 inches. The focal length of the system was increased fifty percent, with a relative reduction in speed, by displacing the focal plane five inches.

Designed to offer a long focal length system in a very short, lightweight package, the instrument is 4 inches in diameter, 10 inches long, and weighs 2½ pounds.

Demonstrated at the American Rocket Society Meeting, the lens can be adapted to standard television cameras, still and movie cameras and astronomical and terrestrial telescopes.

## Names in the News

Earle F. Cook, Deputy Chief Signal Officer, USA, has been promoted to Major General. Prior to his appointment as Deputy Chief Signal Officer last July, General Cook held several important research and development posts.

The first solar conversion for satellites, which was used with Vanguard I, and the Cloud Cover satellite were developed at the U. S. Army Signal Research and Development Laboratory, Fort Monmouth, N. J., while General Cook commanded the Laboratory from 1955 to 1958.

General Cook directed Project SCORE, which was developed by the Army Signal Corps for the Advanced Research Projects Agency, when he headed the Research and Development Division in the Chief Signal Office for a year and a half just prior to becoming Deputy Chief Signal Officer.

John W. Guilfoyle has been elected president of Federal Electric Corp., the service organization of International Telephone & Telegraph Corp. Mr. Guilfoyle, who joined ITT in 1951, had served as Executive Vice President of FEC since October 1958.

Arthur F. Perkins has been named to head the newly established Advanced Development Section in Stromberg-Carlson's Telecommunication Div. Mr. Perkins was formerly with General Electric Co.

Ronald L. McFarlan has been elected president for 1960 of the Institute of Radio Engineers. Mr. McFarlan is a consultant to Datamatic Corp. and Raytheon Co. IRE vice presidents are J. A. Ratcliffe, head of radio research, Cavendish Laboratory, Cambridge, England, and J. N. Dyer, vice president, Research and Engineering Div., Airborne Instruments Lab.

Capt. H. J. Goldberg, USN, has been appointed Assistant Chief for Supply Management, Bureau of Supplies and Accounts, Navy Department. Capt. Goldberg was Commanding Officer, U. S. Naval Electronics Supply Office, Great Lakes, Ill.

William C. Holmes has been appointed vice president and manager of the Space Communications Div., Radiation, Inc. Mr. Holmes was formerly Assistant Weapon Systems Manager and Administration Director of the WS-117L Satellite Program at Lockheed Aircraft Corp.

# Western Electric Pioneers Major Break-Through in Computer Technology

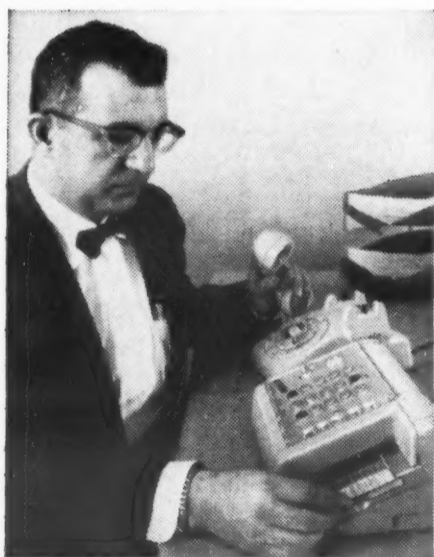
**I**N-line computers, those that process a continuous flow of information and up-date their memory units, are ideally suited to handle business transactions. Their usage has been limited, however, by the high costs of preparing data for input and the human errors associated with its preparation and transmission.

For example, in an experimental centralized computer installation handling orders from telephone company employees for equipment and supplies, Western Electric engineers found that preparing input data cost over four times as much as all subsequent clerical operations. The reason for the cost was the large number of individual orders, instructions, reports and the like flowing in from hundreds of locations. Each had to be prepared, typed, edited and transmitted.

Computers operate from holes punched in cards or tape, or from signals recorded on magnetic tape. Although there are a number of transmission systems that make data available in one or another of these forms, the cost is prohibitive unless the lot quantity of data is very large. Nor do these systems eliminate the initial preparation and translation into machine language.

There was a clear need for a simple, easily-operated remote input device that would be low in cost and could eliminate the manual preparation of needed information. It had to be capable of directly feeding the computer, or of punching standard cards at the receiving end if the computer was being utilized on another project at the time of transmission.

## How Western Electric Met The Need



Original hand-made model of new data input device. Engineering now in progress at Western Electric will reduce the size of the unit to about that of a breast-pocket wallet.

Entirely new principles and applications were necessary at both the transmitting (or ordering) end and the receiving end.

The engineers decided that the best way to cut the cost of preparing, typing and editing orders was to eliminate these operations. Why not provide the many ordering locations with a punched card for each item handled, transmit the information over standard telephone lines using card readers and reproduce the information at the computer? While the solution sounds simple, extensive engineering development was necessary.

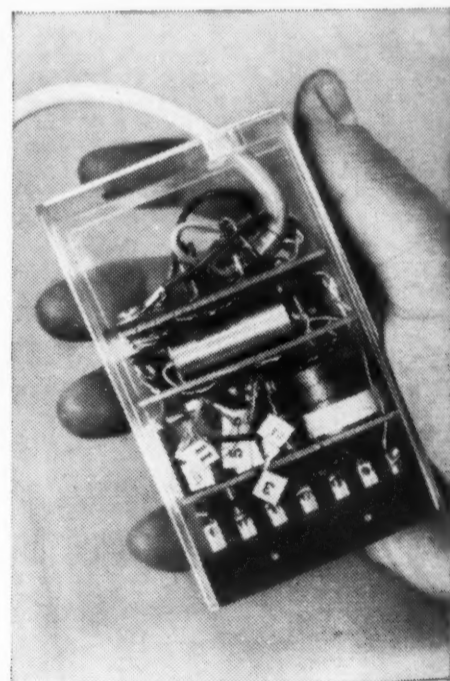
Final result of Western Electric's engineering will be a small unit that plugs into a standard telephone outlet. Prior-punched cards will be inserted in this unit, and the data they contain converted to pulses that will be transmitted over telephone lines to a centrally-located computer. Additional data such as quantity, delivery dates and so on, will be added by using a simple keyboard. When all the pertinent data has been transmitted to the computer, it will then take over. Orders, inventory control forms, packing slips, even routing instructions for the shipments, will all be automatically prepared and elimination of multiple clerical operations accomplished.

## Significant Break-Through

We expect this new development of Western Electric engineering to assist us in our assignments as manufacturing and supply unit of the Bell System. It will expedite order processing, eliminate much clerical work, simplify inventory control and aid in many ways to provide the equipment the Bell Telephone Companies need. Although Western Electric itself has no plans to market the remote input device, even the briefest reflection will indicate the implications of this latest break-through by Western Electric engineering—to National Defense and to business everywhere.



At the receiving end, operator can feed incoming data directly to the computer or into a standard card-punching machine simply by throwing a key.



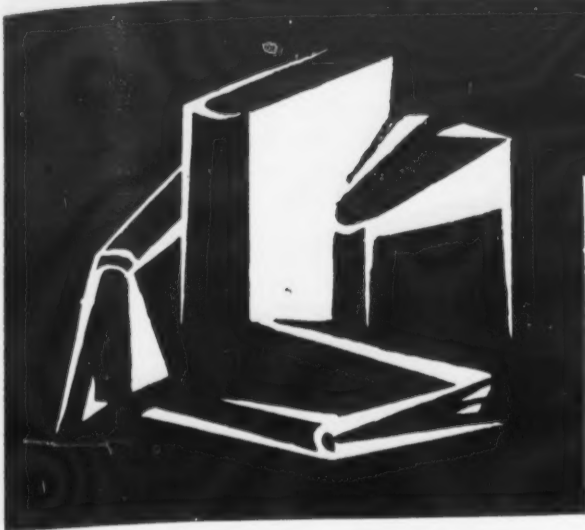
Western Electric engineers are miniaturizing this multi-frequency oscillator, the transistorized electronic heart of the new remote data input system. It makes use of low voltages normally used in telephone lines and requires no outside power supply.

# Western Electric

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## Books

**RADIATION, GENES, AND MAN**, by Bruce Wallace and Th. Dobzhansky. Henry Holt & Co., Inc., N. Y., 1959. 205 pages, \$3.50.

It is very difficult to find a current news publication that does not contain a statement made by one person or another concerning the continuing or discontinuing of atomic and hydrogen bomb tests. We, as a nation, are in a state of debate on this issue. We, as members of the family of man living in the beginning of an Atomic age, are finding it necessary that we understand the problems involved and the issues at stake in decisions regarding the use of man-made radiation. Whether it emanates from an atomic bomb test explosion in the form of fallout or from an x-ray unit in a doctor's office, this radiation is capable of causing grave physiological and genetic damage to those exposed.

The information presented here stresses the point of view that our present data and information on which conclusions should rest are as yet wholly inadequate. The authors contend that the very urgent need of today is further research on the genetics of populations and on radiation genetics. They have presented a summary of the essential genetic information available today concerning the threat of genetic damage to man. The book provides the careful reader an opportunity to assess for himself the validity of opinions and conclusions which will influence the state of health of human life many generations from now.

Dr. Wallace, a professor at the New York State College of Agriculture at Cornell University, participated in a 1959 symposium on the "Immediate and Low Level Effects of Ionizing Radiations," held in Venice. He was also a member of the committee convened by the World Health Organization to consider the effect of radiation on human heredity and a member of the U. S. delegation to the First International Conference on the Peaceful Uses of Atomic Energy held at Geneva in 1955.

Dr. Dobzhansky is a professor of zoology at Columbia University and one of the leading authorities on genetics and evolutionary differentiation of species.

**SPACE HANDBOOK. ASTRONAUTICS AND ITS APPLICATIONS**, by Robert W. Buchheim and the Staff of the RAND Corp. Random House in cooperation with the USAF Book Program, 1959. 330 pages, \$3.95.

The U. S. House of Representatives' Committee on Astronautics and Space Exploration requested The RAND Corp. of Santa Monica, Calif. to undertake a study which would set forth in lay terms the present and definitely foreseeable state of the art of space flight.

In the words of the Committee, "The report which follows . . . represents the most comprehensive unclassified study on the subject now available. The report is confined to technical and scientific analysis, avoiding expressions of opinion and policy and administrative matters. It studiously avoids borderline speculative judgments on the pace of future development."

The material in the book is presented in four sections and an appendix and a glossary are also included. The introduction includes historical notes, the general nature of astronautics, the current state of space technology and action considerations. Part Two, devoted to technology, covers propellants, rocket vehicles, propulsion systems, guidance, communications and about a dozen other aspects of space technology. Part Three, covering applications, goes into specific flight possibilities, observation satellites, navigation and meteorological satellites and satellites as communication relays. Part Four describes astronautics in Russia, the United Kingdom and in the People's Republic of China.

Anyone interested in understanding and evaluating our nation's role in the area of space exploration and astronautics will find this book of extreme value.

**THE WEST POINT ATLAS OF AMERICAN WARS**, prepared by the U. S. Military Academy's Department of Military Art and Engineering and edited by Col. Vincent J. Esposito. Frederick A. Praeger, Publishers, N. Y., 1959. 2 Volumes, \$47.50.

This is a comprehensive and fully illustrated military history of every

major war in which the U. S. has participated. It contains more than 400 three-color and four-color battle maps accompanied by a concise and illuminating military history.

158 maps in Volume I cover every campaign in the Colonial and Revolutionary Wars, the War of 1812, the Mexican War, the Civil War and the Spanish-American War; Volume II contains 71 maps on World War I, 170 on World War II and 15 on the U.N. action in Korea. Each war is treated in its entirety, so that, for example, the majority of World War I maps are actually concerned with events prior to American entry into conflict.

The maps are dynamic depictions of the movements of forces from day to day enabling the reader to follow the entire course of a campaign or battle in detail. Supplementing the maps are over 250,000 words of descriptive text.

The Atlas, prepared by the Department of Military Art and Engineering of the U. S. Military Academy, employs the basic materials of the famous course given to cadets at West Point and has been selected as the new West Point textbook.

EDITOR'S NOTE: Being a student and collector of military history for forty years, I cannot recommend too highly this recent publication on major U. S. wars compiled after considerable research and study at the United States Military Academy. My personal library contains many works on military operations by outstanding historians and military authors. There is no single text which can compare with *The West Point Atlas of American Wars*. It is an indispensable item for anyone interested in the study of American history.

*Books of interest received too late for this month's review:*

**DICTIONARY OF AERONAUTICAL ENGINEERING**, by J. L. Nayler. Philosophical Library Inc., N. Y., 1959. 318 pages, \$10.00.

This is an illustrated dictionary providing concise definitions with special emphasis given to developments in aerodynamics, aero engines, electronic and electrical engineering, jet propulsion, propellants, guided missiles, rockets, high speed flight and artificial satellites.

**MOST DANGEROUS SEA**, by Arnold S. Lott, Lt. Comdr., USN. United States Naval Institute, Annapolis, Md., 1959. 322 pages, \$6.00.

The book is a history of mine warfare and an account of U. S. Navy Mine Warfare Operations in World War II and Korea.

## Influence of Nuclear Technology

(Continued from page 56)

precise and must be scrutinized with the greatest care. This I assure you is a process which is going on continually within the government and while at times it produces agonizing answers to some who have understandable hopes and desires, such screening processes are nevertheless a must in this new game of apparently unlimited scope.

When decisions are made concerning our objectives we must then marshal our best scientific and technical talents in such a way that our goals can be accomplished in a minimum time. This is an essential step in space exploration. It is equally essential in defense expenditures, in basic research and in the development of atomic energy, a field of my immediate concern.

This calls upon us to be tough-minded. We must select the projects which are essential to our advancement and our security in the light of evolving technology and we must defer those things which fall in the category of being perhaps desirable but not essential.

If we had time and infinite human material and financial resources such decisions would not be necessary. We do not have the time, and the horizon of possible areas of effort is so vast that neither we nor any other nation have the resources to do everything, hence the imperative requirement of selectivity.

I believe in the space program. Furthermore, I am convinced that nuclear rockets and nuclear-electric energy sources have an indispensable role to play in this program. Others have views to the contrary. This then becomes another example of one of the perplexing decisions we must take. We must decide firmly, clearly—and decide now—the extent to which we should plan on the use of nuclear energy in our space program. When this is done, I pledge you the strong, vigorous, and continuous support of the Atomic Energy Commission.

I would not wish to leave you with the impression that I feel that our programs should be based entirely on existing knowledge.

We have seen gigantic advancements in many fields, including nuclear energy, during the last fifteen years. If the prospects for the next decade look less impressive than they once did, this probably is due to our limited imagination rather than to any objective reason.

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### INDEX TO ADVERTISERS

Adler Electronics, Inc. <i>Zam and Kirshner, Inc.</i> ..... 56	Institute of Radio Engineers <i>Raymond Schoonover Adv.</i> ..... 17
Alden Electronic & Impulse Recording Equipment Co., Inc...8, 9	D. S. Kennedy & Co. <i>Larcom Randall Adv., Inc.</i> ..... 1
Automatic Electric Co. <i>Kudner Agency, Inc.</i> ..... 59	Moore Associates <i>Lawrence &amp; Ramberg, Inc.</i> .... 12
Avco Corp., Nashville Div. <i>Benton &amp; Bowles, Inc.</i> ..... 2	Philco Corp., Government & Industrial Div. <i>Maxwell Associates</i> ..... 51
Bomac Laboratories, Inc. <i>Larcom Randall Adv., Inc.</i> ..... 4th Cover	Plessey International Ltd. <i>Roles and Parker Ltd.</i> ..... 22
Burke & James, Inc. <i>William Futterman Adv.</i> ..... 42	Radio Corporation of America, Defense Electronic Products Div. <i>Al Paul Lefton Co., Inc.</i> ....3rd Cover
F X R, Inc. <i>Beecher Associates</i> .....2nd Cover	Radio Corporation of America, Electronic Data Processing Div. <i>Al Paul Lefton Co., Inc.</i> ..... 49
Gates Radio Co. <i>Sander Rodkin Adv. Agency, Ltd.</i> ..... 57	Railway Communications, Inc. <i>Hal Barnes Adv.</i> .....33, 34
General Electric Co., Heavy Military Electronics Dept. <i>G. M. Basford Co.</i> ..... 43	Raytheon Co. <i>Donahue &amp; Coe, Inc.</i> ..... 4
General Electric Co., Special Programs Sec., Defense Systems Dept. <i>B. K. Davis and Brother Adv. Service</i> ..... 60	Stancil-Hoffman Corp. <i>Consolidated Advertising Directors</i> ..... 40
Hoffman Electronics Corp. Hoffman Laboratories Div. <i>Honig-Cooper, Harrington &amp; Miner, Inc.</i> ..... 24	Times Facsimile Corp. <i>Fletcher Richards, Calkins &amp; Holden, Inc.</i> ..... 61
	Western Electric Co. <i>Cunningham and Walsh, Inc.</i> .... 64

### Chapter News

(Continued from page 55)

University. They were conducted on a tour of the Cyclotron facility by Dr. J. B. Reynolds, Cyclotron Director, and were presented with an operational demonstration, showing production of radio-isotopes and detection of associated radio activity. There was also a guided tour of the Radio Chemistry Laboratory with related demonstrations.

#### Southern California

The Pacific Ballroom of the Statler Hilton Hotel in Los Angeles provided the setting for the November 18 dinner-

meeting of the chapter. "Air Force Role in Space" was the subject of a talk presented by Col. Richard D. Curtain, Deputy Commander, Air Force Ballistic Missile Division, Hqs. ARDC.

#### Tokyo

The Tokyo chapter met October 29 in the Far East Room of the Sanno Hotel and then divided into two tours. Part of the group went to the Tokyo Telephone Central Exchange and the other part went to the Toho Movie Studio. Those touring the movie studio walked around the surface of the moon—a set awaiting a science fiction film, a false front village and several other sets in the process of filming.

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velocity, target position, barometric pressure, and other data into information for surface to surface missile firings. The soldier-technician monitoring the exchange of computer data will have modularized communications with the other elements of his tactical organization. RCA is the leader contractor of this important United States Army Signal Corps program and is working in close harmony with the electronic components industry.



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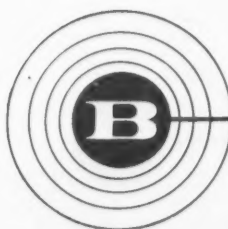
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